PM 5415 PM 5418
COLOR TV PATTERN GENERATOR

Service Manual

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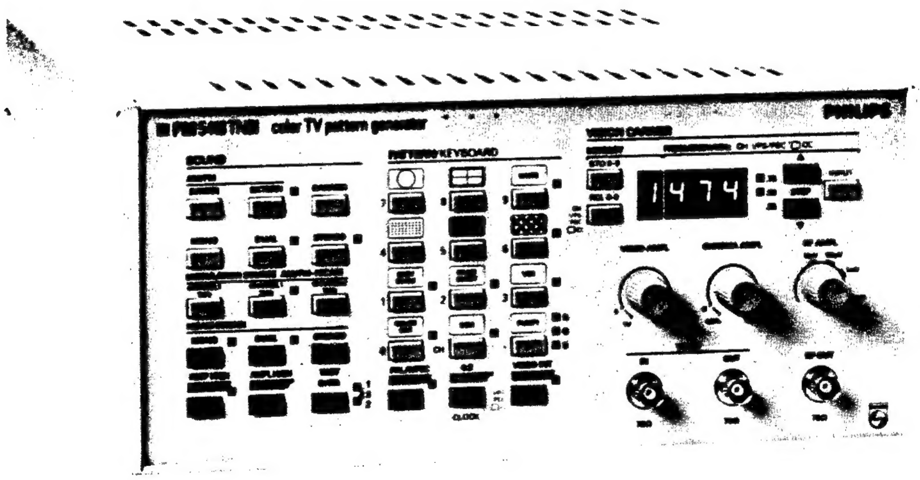

PHILIPS

Please note

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

Bitte beachten

Bei Schriftwechsel über dieses Gerät wird gebeten, die Typennummer und die Gerätenummer anzugeben. Diese befinden sich auf dem Typenschild an der Rückseite des Gerätes.

Noter s.v.p.

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Important

As the instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

Wichtig

Da das Gerät ein elektrisches Betriebsmittel ist, darf die Bedienung nur durch eingewiesenes Personal erfolgen. Wartung und Reparatur dürfen nur von geschultem, fach- und sachkundigem Personal durchgeführt werden.

Important

Comme l'instrument est un équipement électrique, le service doit être assuré par du personnel qualifié. De même, l'entretien et les réparations sont à confier aux personnes suffisamment qualifiées.

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1 SAFETY INSTRUCTIONS

WARNING

These service instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the Operating Instructions unless you are fully qualified to do so.

Read these pages carefully before installation and use of the instrument.

The following clauses contain information, cautions, and warnings which must be followed to ensure safe operation and to keep the instrument in a safe condition. Adjustment, maintenance, and repair to the instrument shall be carried out only by qualified personnel.

1.1 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where they apply, will be found throughout the manual. Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.2 CAUTION AND WARNING STATEMENTS

CAUTION

Is used to indicate correct operating or maintenance procedures to prevent damage to or destruction of the equipment or other property.

WARNING

Calls attention to a potential danger that requires correct procedures or practices to prevent personal injury.

1.3 SYMBOLS

⏚ Protective earth (black symbol on yellow background) (grounding) terminal

1.4 IMPAIRED SAFETY PROTECTION

Whenever it is likely that safety protection has been impaired, the instrument must be disconnected from power and be secured against any unintended operation. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

1.5 GENERAL CLAUSES

WARNING

The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts and accessible terminals which can be dangerous.

The instrument shall be disconnected from all voltage sources before it is opened.

Capacitors inside the instrument can hold their charge even if the instrument has been removed from all voltage sources.

WARNING

Any interruption of the protective earth conductor inside or outside the instrument, or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

Components which are important for the safety of the instrument may only be replaced by components obtained through your local FLUKE/PHILIPS organization (see also Chapter 10).

After repair and maintenance in the primary circuit, safety inspection and tests, as mentioned in Chapter 9, must be performed.

1.6 ISOLATION TRANSFORMER

Because most MTV and CTV receivers are constructed with the chassis potentially "live", it is sensible precaution to power the receiver under test via a suitable isolating transformer.
This permits direct connection of the television chassis to the earth terminals of any test instrument thus providing a common signal path and reducing the risk of electric shock.

2 LINE VOLTAGE SETTING AND FUSES

The safety instructions in previous chapters must be followed.

Before plugging in the power cord make sure that the instrument is set to the local line voltage.

WARNING

If the power cord has to be adapted to the local situation, such adaption should be done by a qualified person only.

On delivery from the factory the instrument is set to one of the following line voltages:

Instrument version	Instrument code no.	Line voltage setting	Delivered power cable
PM 5415	9452 054 15..1	220 V	Europe, Schuko
PM 5415	9452 054 15..3	120 V	North America
PM 5415	9452 054 15..4	240 V	United Kingdom
PM 5415	9452 054 15..5	220 V	Switzerland
PM 5415	9452 054 15..8	240 V	Australia
PM 5418	9452 054 18..1	220 V	Europe, Schuko
PM 5418	9452 054 18..3	120 V	North America
PM 5418	9452 054 18..4	240 V	United Kingdom
PM 5418	9452 054 18..5	220 V	Switzerland
PM 5418	9452 054 18..8	240 V	Australia

The set line voltage and the corresponding fuse rating are indicated on the rear panel.

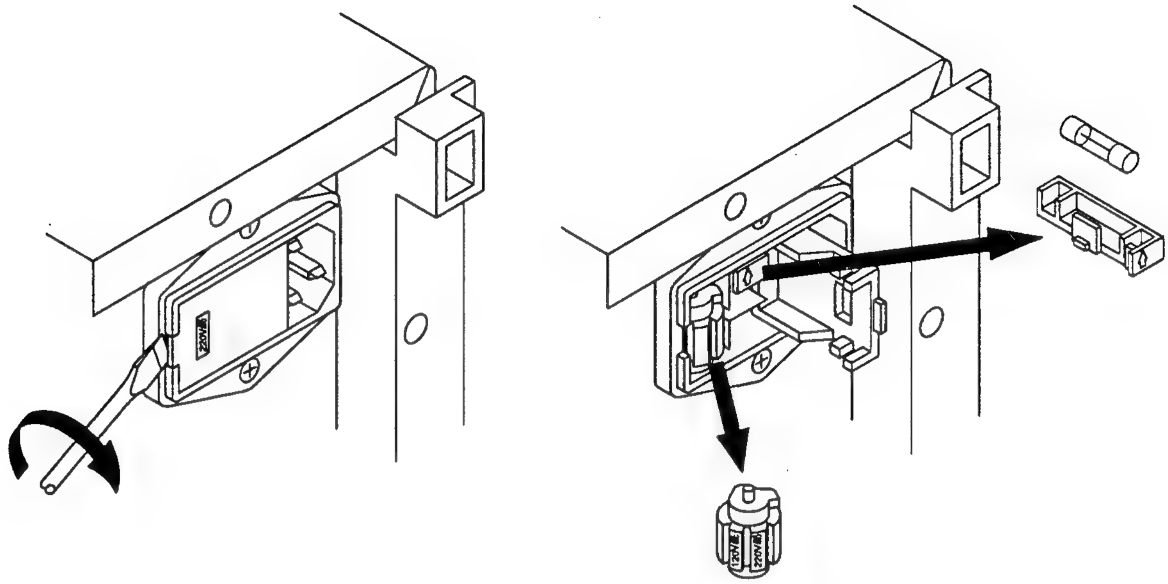
Make sure that only fuses of the required current rating, and of the specified type, are used for replacement. The use of repaired fuses and/or the short circuiting of fuse holders are prohibited. The fuse should be replaced only by a qualified person who is aware of the hazard involved.

WARNING

To prevent electric shock, the instrument must be disconnected from all voltage sources when a fuse is to be replaced or when the instrument is to be adapted to a different line voltage.

The instrument can be set to the following line voltages: 100 V, 120 V, 220 V, and 240 V ac. These nominal voltages can be selected via the voltage selector, located at the rear panel, adjacent to the power socket. The fuse is located in a holder at the same place. For line power voltage selection or replacement of the fuse, remove the power cord and pry open the compartment with a small screwdriver (see drawing next page).

Select one of the voltage ranges, as appropriate, by turning the selector. If necessary, insert the correct fuse (T0.315A or T0.63A) into the fuse holder instead of the original one.



3 SERVICE PROCEDURE

The PM 5415 / PM 5418 Color TV Pattern Generators are repaired on **single component level** or by **complete unit exchange.** For this all related circuit diagrams, component layouts and parts lists are published in this Service Manual. Some units have a multilayer PCB with mounted SMD components for example the Digital Unit 1, NICAM Units, and Teletext-PDC Unit. Special hints are given in Section 10.7.1 SMD Handling and Replacement.
Figure 101 shows the Overall Circuit Diagram with the interconnections between the Motherboard and the RF Unit (U10), Keyboard/Display Unit (U12), and the IEEE-bus Unit (U13). Figure 103 shows interconnections to Units U1 to U8. For getting access to the parts, see Chapter 6, 'Dismantling the Instrument'.

For repair and tests a **Service Kit** is available comprising 2 extension test boards and extraction tools, service code no. 5322 310 10579, see Figure 59.

Complete units can be ordered by service code numbers. In case of NICAM replacements the complete adjusted set of two boards, TWIN LF Unit (U7/TWIN) and TWIN RF Unit (U8/TWIN), must be replaced.

A recalibration interval of 1 year is recommended for instruments including NICAM sound or IEEE-bus Unit and 2 years for all other versions.

If you need any assistance with relation to service on this instrument, you may well contact your local Fluke/Philips organization.

4 CIRCUIT DESCRIPTION

4.1 GENERAL

Chapter 4 is intended to be used for understanding the functions of the electronic circuitries in conjunction with the circuit diagrams in order to perform effective **fault finding and repair.**
For the best survey about the units see
- Block Diagram, Section 4.2 and Figure 90
- Figure 100, Survey of Units and Versions
- Figure 101, Overall Circuit Diagram
- Figure 103, Motherboard Part 1, Circuit Diagram

Disassembling the instrument (details see Chapter 6)

The single plug-in units U1 to U8 are mechanically fixed at both sides and secured against unwanted lift-out. Additionally all units are fixed by a transverse ridge. For service purpose the units can be lifted by an extraction-tool. All components and adjustment items are accessible by means of the extension test boards (see Section 8.2). So the instrument is in full operation best suitable for fault finding.

Figures 27 to 29 are not meant for check and adjustment purposes, but are values and signal shapes according to the TV system and so are fulfilled by the instrument.

Some main signals controlling all subunits are the
Vertical field pulse (V, fV) and the
Horizontal line pulse (H, fH).
Denominations of multiples or sub-divided frequencies are not always uniform due to the data sheets of the suppliers of components, for example:

fH80	80 x line frequency = 1.25 MHz
fH2 = fH/2	line time divided by 2 = 32 µs

4.2 BLOCK DIAGRAM

Different models are available to meet the need for specific test functions like Stereo and NICAM sound, teletext, VPS, PDC, Closed Caption (CC), Y/C and RGB outputs.
The Block Diagram presents the extended pattern generator PM 5418 TNSI.

Five supply voltages are generated by the **Power Supply** of the motherboard (Unit 11).
Three stabilized voltages +5 V, −12 V, and +12 V. A supply voltage of +6 V is used for some CMOS components. A slightly stabilized voltage of +30 V is used for the tuning voltage amplifier of the CITAC.

The **Central Processing Unit (CPU)** on the motherboard consists of a microprocessor with RAM and PROM, a combined RAM/port circuit for input and output operations and the CITAC for adjustment and control of the VCOs on the RF Unit.
The 8085 microprocessor reads the program instructions from PROM D313. Address latch D312 serves for generating the address information. Communication with the subunits is achieved via the internal I^2C-bus (RAM, CITAC) and via the C-bus.
The RAM/port IC314 contains the working memory for the microprocessor and all outputs for controlling the subunits. Input port A of IC314 enters the status signal from the sound and teletext units and the binary codes from the PAL/NTSC- and SECAM system switches.
The battery buffered RAM saves the complete parameters set-ups.

The **Master Oscillator** on the motherboard generates the reference frequencies for PAL/SECAM or NTSC, which clocks the **Sync Pulse Generator.** This circuit generates the horizontal H and vertical V pulses and their subdivided pulses which control all circuitries in the instrument. It also organizes the subcarrier lock in combination with the subcarrier coupler on the PAL/NTSC Unit.

The **Digital Unit** generates the digital signals for all test patterns except Multiburst. Digital test patterns like Center Cross, Dots, Crosshatch, and Checkerboard as well as Circle and 100 Hz Test pattern are generated by circuitries for the Horizontal and Vertical Coordinates and the pattern PROMs D114 and D125. The 16:9 or 4:3 pattern format is stored in the Pattern PROM. These patterns are selected by the Digital Pattern Control Latch via the internal C-bus.
The Moving-bar of the VCR pattern is generated by circuity D112/D113.
The pattern data for the analog test patterns, for example Color Bar, DEM, and Greyscale are stored in the Analog Pattern Memory. Available test patterns and combinations depend on software version.

The digital to analog conversion of the luminance information is realized in the Luminance Summing Point on the motherboard. The conversion of the chrominance information takes place in the U/V-Matrix on the PAL/NTSC Unit or in the D'R/D'B-Matrix on the SECAM Unit.

For instruments with PDC and the Video-Programme-System (VPS) additional signals are generated by a different **Digital Unit VPS**.

All video signals, for example luminance, chroma, multiburst, and teletext are fed through the **CVBS Summing Amplifier** on the Main Unit to the VIDEO OUTPUT. Furthermore the signals are fed via an amplifier, where the correct video polarity is selected and the residual carrier can be adjusted, and via the RF modulator to the RF OUTPUT.

On the **PAL/NTSC Unit** a VCO generates the color subcarrier frequencies for the different TV systems by a Phase Locked Loop (PLL). So correct relationship between the subcarrier and line frequency is achieved. On a second part of this unit the complete chroma from the Digital Unit, consisting of the color components, the saturation step signals and the vector information together with the PAL or NTSC burst are applied to the U- and V-matrix. The color difference signals are composed in two summing points and fed via a lowpass filter to the PAL/NTSC encoder. This circuit encodes the color difference signal R-Y and B-Y onto one subcarrier. Quadrature modulation allows the coding to be in accordance with either the PAL or NTSC system.

The **SECAM Unit** (PM 5418 only) consists of a modulator and an encoder as well as circuitries for signal shaping according to the SECAM system.
The chrominance information from the Digital Unit is weighted, summed and fed to the encoder which produces sequential, frequency modulated color signals. Further circuities are the band limitation, the low frequency pre-emphasis and the high frequency 'Anti-bell Filter'.
The modulator controller TDA2507 generates two subcarrier frequencies necessary for the modulation and supplies a control voltage for the encoder.

Depending on instrument versions different **Teletext Units** are built in, Teletext TOP/FLOF or Teletext/PDC/CC.
The **Teletext TOP/FLOF Unit** generates UK-Teletext including TOP, FLOF/FASTEXT, VPT functions and Didon Antiope Teletext. The contents of the Teletext pages depends on software. The Teletext signals are sent in special lines in the vertical blanking period before the active TV picture starts. These lines are decoded by the line decoder. The teletext clock is generated by a PLL, 6.937 MHz for UK-Teletext and 6.203 MHz for Antiope.
A sub-divided frequency reads parallel teletext data from the teletext PROM which are serialized and formed by a filter path. The complete teletext signal is applied to the video summing amplifier on the main board.
The **Teletext/PDC/CC Unit** offers additionally Programme Delivery Control (PDC) and Closed Caption (CC) functions.

For the **RGB & Y/C Unit** the complete luminance data are applied from the Digital Unit. The luminance data are weighted in three summing points for RED, GREEN, and BLUE. The single color components are applied via $\sin^2$-filters to amplifier output stages. The sync signal and the PAL/NTSC subcarrier complete the five output signals.
The luminance and chroma signals are available at the Y/C OUTPUT.

The multiburst pattern is generated by the **Multiburst Unit**. The unit comprises a counter, a summing amplifier, current sources for the subsequent triangle generators, a sine shaper, and a start/stop circuit.
On each TV line the circuit delivers 8 packages of sine waves.
A counter with subsequent summing amplifier delivers a staircase signal which in a triangle generator is converted into packages of sinewaves with stepwise increased frequencies from 0.8 MHz to 4.8 MHz.

Depending on instrument versions different **Sound Units** are built in. The dual/stereo sound versions PM 5415 / PM 5418, indicated by an 'X' in the type number, are equipped with two sound units: LF Stereo Sound Unit and RF Stereo Sound Unit.
Instruments with NICAM sound, indicated by an 'N' in the type number, have two TWIN sound units: TWIN LF Unit and TWIN RF Unit. Standard instruments are equipped with the Mono Sound Unit.

The **Mono Sound Unit** generates 1 kHz sound and the different sound carrier frequencies depending on the selected TV system (4.5, 5.5, 6.0, or 6.5 MHz) controlled by a PLL. The unit is controlled by the CPU via C-bus.

The **LF Stereo Sound Unit** generates the audio frequencies 1 kHz and 3 kHz, the pilot carrier 54.68 kHz, and two identification frequencies 274.1 Hz/117.5 Hz in the DUAL/STEREO mode. The line frequency serves as reference. Dual and stereo sound are only possible in the TV system PAL G. The different sound modes are controlled by the CPU via the C-bus.

The **RF Stereo Sound Unit** generates the sound carrier frequencies 4.5, 5.5, 6, and 6.5 MHz for the different TV systems. The unit is controlled by the CPU via the internal C-bus. Depending on the chosen TV system the frequencies for sound carrier 1, modulation, and carrier levels are selected. The sound carrier 2 frequency 5.742 MHz is generated in the DUAL or STEREO mode.
Sound carrier 1 and sound carrier 2 are summed up and applied to the RF Unit.

In the **Twin LF Unit** the analog audio frequencies 1 kHz, 3 kHz as well as the pilot carrier 54.68 kHz and identification frequencies 274.1 Hz, 117.5 Hz are generated. The frequencies are controlled by a PLL.
For the NICAM sound about 60 data sets are stored in the Sound-data PROM. Sound data are read out by an address counter and converted into the resulting final I- and Q-data are applied to a 4-QPSK modulator of the TWIN RF Unit.

In the **TWIN RF Unit** a 11.34 MHz reference frequency and two sound carriers are generated by a PLL controlled from the CPU. Depending on the selected TV system the carrier frequencies 1 and 2 are switched. Furthermore FM/AM modulation of sound carrier 1 and FM or 4-QPSK modulation for the NICAM sound carrier 2 is realized.

The **RF Unit** serves for generating a double-sideband modulated TV signal in the frequency range 32 MHz to 900 MHz. The unit consists of six oscillators, two amplifiers, modulator part, divider and lowpass filter. All circuits are built into screened sections in the RF Unit.
The six oscillators (VCO) for the RF carrier frequency are turned on and tuned by the CITAC on the motherboard.
The RF carrier is fed into a mixer which is used as AM modulator. The video signals are added at its modulating input. From the mixer output the modulated RF carrier is fed via the lowpass filter path and the RF attenuator to the RF OUTPUT.

The **Keyboard and Display Unit** contains a 4-digit LED display, 22 to 29 keys with the assigned LEDs next the keys (depending on version) and its decoder/driver circuits. Data transfer from the CPU is performed via the C-bus.
The keyboard encoder controls a keyboard matrix and sends a serial keycode to the CPU.
Instruments with NICAM sound have an extended keyboard with a different PCB and 35 keys.

4.3 MOTHERBOARD; MAIN UNIT 11

The motherboard comprises several functional units or parts of them and serves for interconnections between the different plug-in units. Overview Figures 101 to 106:

Figure 101: Overall Circuit Diagram

Figure 102A: Component Layout including Connectors and Test Points TP1 to TP 12.

Figure 103: Circuit Diagram of the master oscillator, universal sync generator, TV system control, luminance summing point, connections to plug-in units U1 to U8 and outputs for audio and trigger signals.

Figure 104: Power Supply

Figure 105: Central Processing Unit (CPU), CITAC (RF tuning control) and TV system switches.

Figure 106: Pre-amplifier for External Video Input, video summing points and analog video path of the composite video signal to external video outputs and to RF Unit (U10).

4.3.1 Power Supply (Part U11), Figure 104

Five supply voltages are generated by the supply section of the motherboard (Unit 11).
Three stabilized voltages, +5 V, −12 V, and +12 V are realized by four-terminal voltage regulators 304, 301 and 302. These three voltages are used in all plug-in units 2 to 8; +5 V is applied to pins 46 of the multiple-pin plugs, +12 V to pins 45 and −12 V to pins 44.
A slightly stabilized voltage of +30 V is used for the tuning voltage amplifier of the CITAC (IC318 Unit 11) which generates the AFC voltage for the RF Unit (U10).
The instrument can be set to line voltages 100 V, 120 V, 220 V, or 240 V via the voltage selector, located at the rear panel.

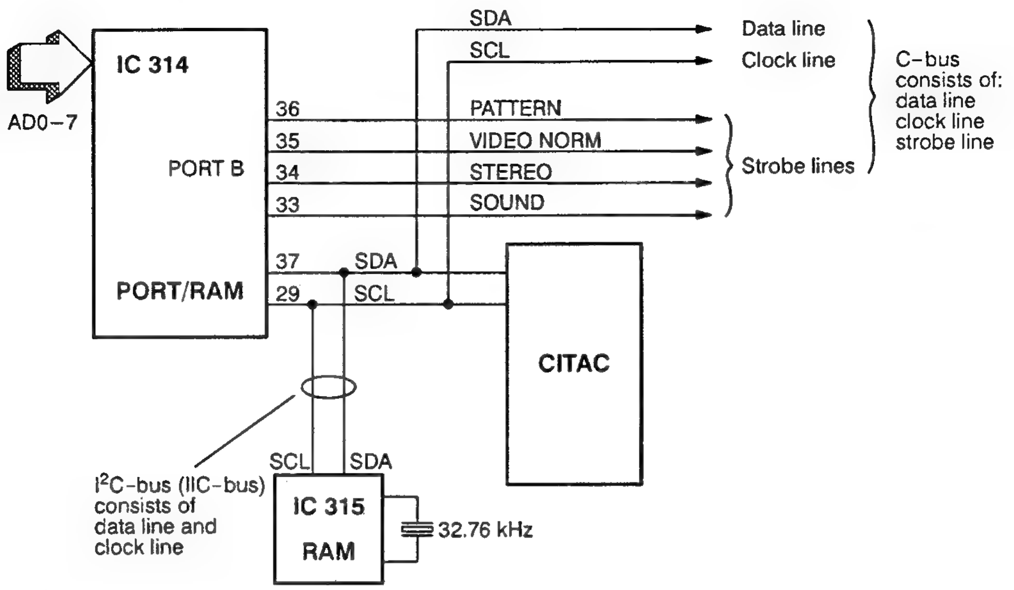
4.3.2 Central Processing Unit (CPU), Figure 105

The CPU consists of a microprocessor 8085 with RAM- and PROM memory, a combined RAM/port circuit P8155 for input- and output operations and the CITAC SAB3036 for adjustment and control of the VCOs in the RF Unit (U10).

The 8085 microprocessor (IC311) reads the program instructions from PROM 313. Address latch 312 serves for generating the address information A0 to A7 for the PROM from the multiplexed address- and data bus AD0 to AD7; the control of this latch is performed with the signal ALE from the processor. Data information from the PROM are fed directly to the bus AD0 to AD7, controlled with A15 and $\overline{RD}$.

The solder switch 'TEST' at the input SID of the processor must be closed when the Test Program shall be started; for the normal operating program 'TEST' must always be open (Test Program, see Section 7.2).

Information from the Keyboard Unit is transferred in serial form to the restart input 7.5 of the processor. Display data sent from the processor to the display/LEDs via data line SDA, clock line SCL and the strobe lines $\overline{\text{LEDEN}}$ and $\overline{\text{DISEN}}$.

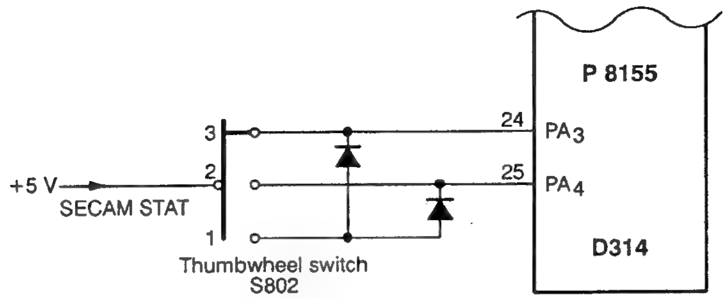


Communication with the subunits is achieved via I²C-bus (for example RAM, CITAC, Digital Unit VPS) and via the C-bus. Because the serial information which are transferred from the CPU are latched and stored in shift-registers in the subunits respectively in the RAM or CITAC, information at data- and clock line can only be measured once for a short moment. According to this function it can be useful to use test six of the diagnostic program in order to measure at the data line SDA and the clock line SCL. Test six enters the binary information from the PAL/NTSC- and from the SECAM standard switch and sends these information via the I²C-bus to the display, thus there is a continuous data flow at the lines SDA and SCL.

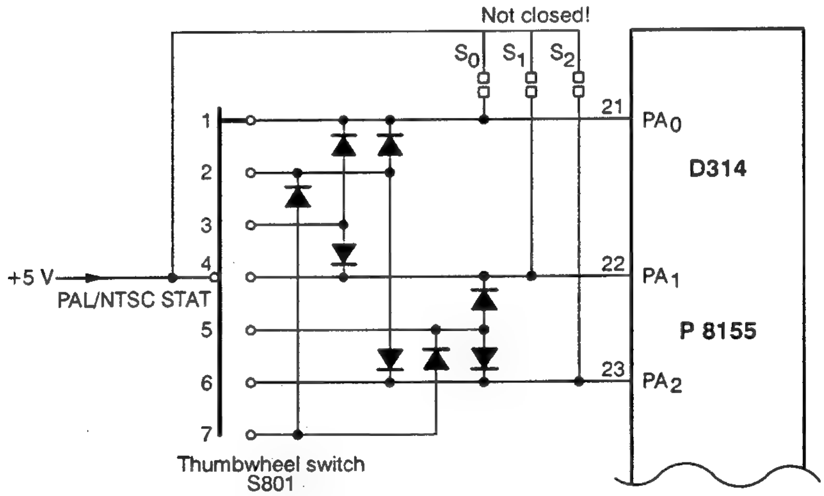
The circuit 315 is a battery buffered I²C RAM for saving complete parameter set ups. The battery is a 3 V Lithium cell connected via diode 413 to the RAM circuit, thus in case of power off or power break down the DC supply for IC315 is automatically taken over from the battery. RAM IC315 includes a clock/calendar function, which is used for the time indication in the teletext pages.

IC314 – the RAM/port circuit P8155 – contains the working memory for the microprocessor (256 bytes) and all inputs and outputs for controlling the subunits. Communication with the processor is achieved via the address/data bus AD0 to AD7 with the help of the control-signals $\overline{\text{RD}}$, $\overline{\text{WR}}$, ALE, IO/$\overline{\text{M}}$, and Reset.

Port A of IC314 is an input port and enters the status signal from the Stereo- and Teletext Unit and binary codes from the PAL/NTSC- and SECAM system switches. Port B drives the strobe lines and the clock line SCL for the internal C-bus, the data line SDA for this bus is driven by port C/bit 0. This internal C-bus is used to transfer control commands from the processor to the subunits.



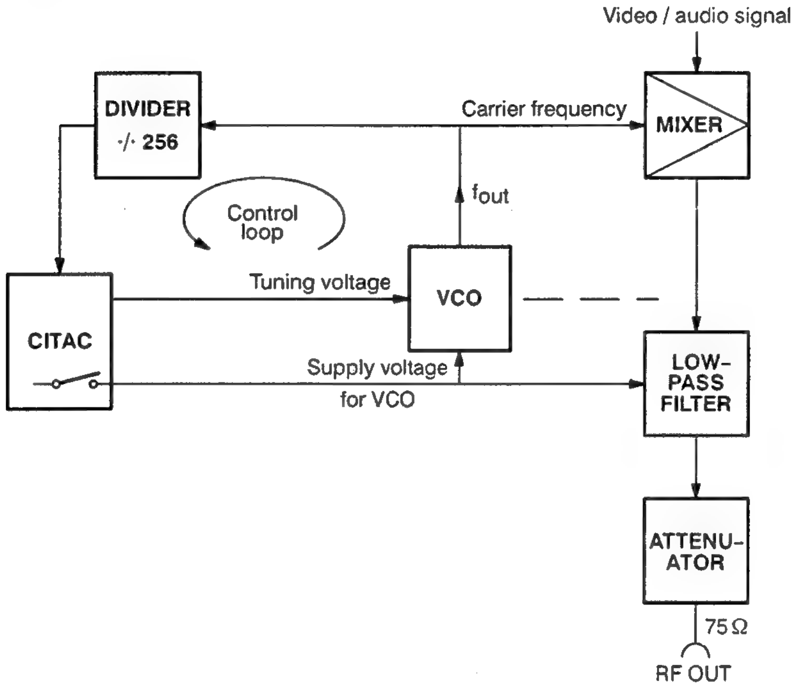
TV System Switch Pos. (S802)	P_{A4}	P_{A3}
3	0	1
2	1	0
1	1	1



TV System Switch Pos. (S801)	P_{A2}	P_{A1}	P_{A0}
1	0	0	1
2	1	0	1
3	0	1	1
4	0	1	0
5	1	1	0
6	1	0	0
7	1	1	1

Frequency adjustment and control of the PLL-loop of RF Unit 10 is achieved by the CITAC chip 318 (SAB 3036). This computer interface for tuning and control is controlled by the microprocessor via the I^2C-bus and feeds the outputs to the RF Unit. For further details of the CITAC, see Annex page 8 and 9.

The outputs P10 to P13, P21, and P22 switch the supply voltage for the VCOs which is in addition to it the control voltage for selecting the according lowpass filter. P10 to P13 of IC318 drive the supply- and control voltage directly, P21 (IC318/2) and P22 (IC318/3) are buffered by transistor 319 (CPU) and transistor 307 (RF Unit), thus the information at pins 2 and 3 of the CITAC are inverted.



This figure shows the principle of frequency setting and control by the CITAC. In the real circuitry there are six VCOs for the six frequency ranges of the generator and lowpass filters adjusted to the corresponding frequency band.

4.3.3 Master Oscillator, Universal Sync Generator, TV System Control (Part U11), Figure 103

The **Master Oscillator** generates the reference frequencies for PAL (5.000 MHz) or NTSC (5.034 MHz) which clocks the universal sync pulse generator SAA1043. Furthermore subdivided frequencies serve as **reference** for the subcarrier and sound carrier oscillators. Adjustment of the clock frequency is achieved by trimmer C542 for PAL and C541 for NTSC.

The **Universal Sync Generator** SAA1043 generates all synchronizing waveforms for the video signal, for example composite sync (CS), composite blanking (CB), vertical (V) and horizontal (H) drive, clamp pulse (CLP), PAL identification (fH/2), and further subdivided horizontal drive frequencies. Details of this circuit as well as the output waveforms are shown in the data sheet in the Annex on pages 3 to 5.

A different sync pulse generation for the TV standards PAL, NTSC, or SECAM is realized by the programming inputs FD, X, and Y, see table below. Non-interlacing for the crosshatch pattern is achieved in the 624- or 524-line mode. In this mode the output signals of the first and second field are identical. Programming information is given by the CPU via the C-bus lines and shift register 321.

To maintain correct relationship between the subcarrier and horizontal scan frequencies the subdivided signals FH80 (1.25 MHz) and FH3 are applied to the subcarrier coupler SAA1044 on the PAL/NTSC Unit. The required TV system for operation is programmed by three control lines FD, X and FH3. To shift the (R-Y) chroma signal by 180° every line the signal DL (2 x fH) is fed from IC324 pin 22 to the color modulator circuit TDA 2501 (U2). This signal is only present for the PAL systems. Horizontal H1 and vertical signals V1 are used among other things for the external trigger output connector. Signals are applied via inverter IC326 to buffer 333 where both signals are added.

Function Table for TV Standards of the Universal Sync Generator SAA1043

TV Standard	TV System Switch SK801	SK802	IC324 Pin No.	FD 7	X 5	Y 6
PAL/CCIR	1,2,3,5	–		L	H	H
PAL-M	4	–		H	H	H
PAL, 624 lines ★	1,2,3,5	–		L	H	L
NTSC/NTSC 4.43	6,7	–		H	L	L
M, 524 lines ★	4,6,7	–		H	H	L
SECAM	–	1,2,3		L	L	L
SECAM, 624 lines ★	–	1,2,3		L	H	L

★ no interlacing (crosshatch pattern only)

Function Table for the TV System Control IC321 and IC331

IC321 Pin No.	TV System PAL G	D	I	M	N	NTSC NTSC	NTSC 4.43	SECAM B,G,H	D,K	L	Function/to Unit
4	L	L	L	H	H	H	H	L	L	L	FD to SAA1044, U2
5	H	H	H	L	H	L	L	H	H	H	X to SAA1044, U2
6	L	L	L	H	L	H	H	L	L	L	FD, SAA1043
7	H	H	H	H	H	L	L	L	L	L	X, SAA1043
13	H	H	H	H	H	H	H	H	H	H	$\overline{\text{VIDEO EXT}}$
14	H	H	H	H	H	L	L	L	L	L	Y, SAA1043
11★	H	L	H	L	L	L	L	L	L	H	PAGE/$\overline{\text{RANDOM}}$, U4
12★	L	H	L	H	H	H	H	H	H	L	$\overline{\text{TELET.ON}}$, U4

Test pattern with interlacing
★ instruments with teletext

IC331 Pin No.	TV System PAL G	D	I	M	N	NTSC NTSC	NTSC 4.43	SECAM B,G,H	D,K	L	Function/to Unit
4	L	L	L	L	L	L	L	H	H	H	SECAM ON, U3
5	L	L	L	L	L	L	L	L	L	H	Video amp. SECAM L
6	L	L	L	L	L	H	L	L	L	L	NTSC, U2
7	L	L	L	L	H	L	L	L	L	L	PAL-N, U2
11	L	L	L	L	L	H	H	L	L	L	PAL/NTSC, U1
12	L	L	L	L	L	L	L	H	H	H	Y-delay $\overline{\text{PAL}}$/SECAM
13	H	H	H	L	L	L	H	L	L	L	$\overline{\text{PAL}}$/NTSC 4.43, U2
14	L	L	L	H	L	L	L	L	L	L	PAL-M, U2

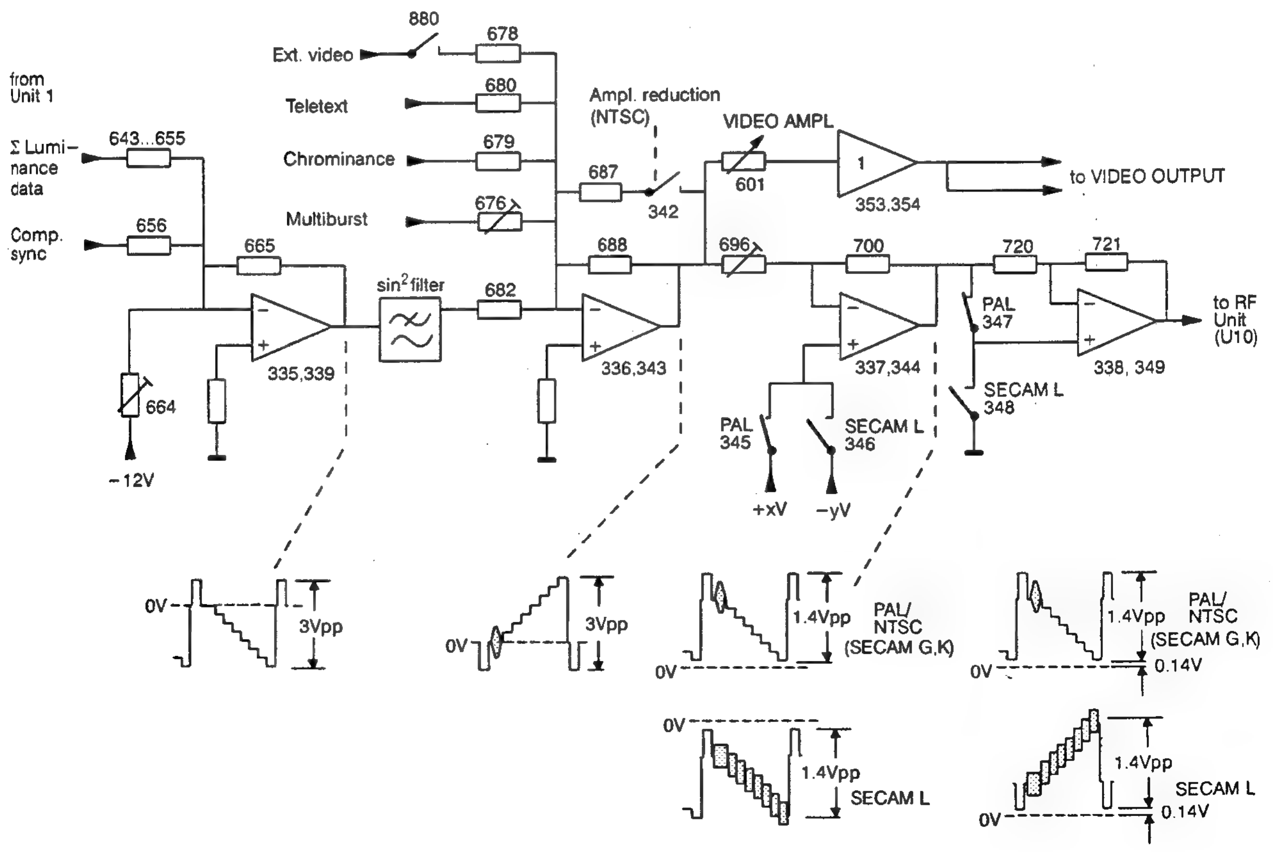
4.3.4 Luminance Summing Point, Video Amplifier, External Video Input (Figures 103, 106)

The **Luminance Summing Point** (Figure 103) comprises buffers 327 to 329 and resistors 643 to 656. The complete digital luminance data are generated by the Digital Unit and are applied via connection 109 pin 15 to 28 from the motherboard. Furthermore the composite sync is applied by signal CS DEL via buffer 329 pin 15. Signals are weighted in the summing point and fed to the following analog video path (see Figure 106).

Dependent on the selected and available TV systems of the instrument luminance data are different, for example signal 'black level offset' is needed only for NTSC and $0.3Y_{R/G/B}$ for the SECAM pattern.

The complete **analog video path** is shown in the Block Diagram and Figure 106. The video path comprises three inverting feedback amplifiers which are similar designed and a fourth stage comprises a voltage follower respectively inverting amplifier. For all TV systems except SECAM L this stage operates as voltage follower. Only in the SECAM L mode the stage is used as inverting amplifier, for a positive vision modulation is needed. The three differential amplifiers are realized by transistor array CA3086 and one transistor BC548 which serves for low output impedance. A zener diode is added to shift the dc output to the input level. The unused transistor array pin 12 to 14 of the first and second stage are connected with the internal substrate to −12 V.

At the input of the first amplifier stage 335, 339 the luminance signal and the composite sync are summed up. After amplification to 3 V_{pp} the signal passes a $\sin^2$-filter which serves for a defined pulse shaping (HAD = 100 ns); for example 2T-pulses (200 ns) are formed during the crosshatch pattern which have $\sin^2$ waveform, see Figure 12.
At the summing point of the second video amplifier 336, 343 the chrominance signal, multiburst pattern, teletext and external video signal are added. In the NTSC mode the amplification of this stage is reduced by switching the feedback-path via FET342.



Block Diagram Video Amplifier

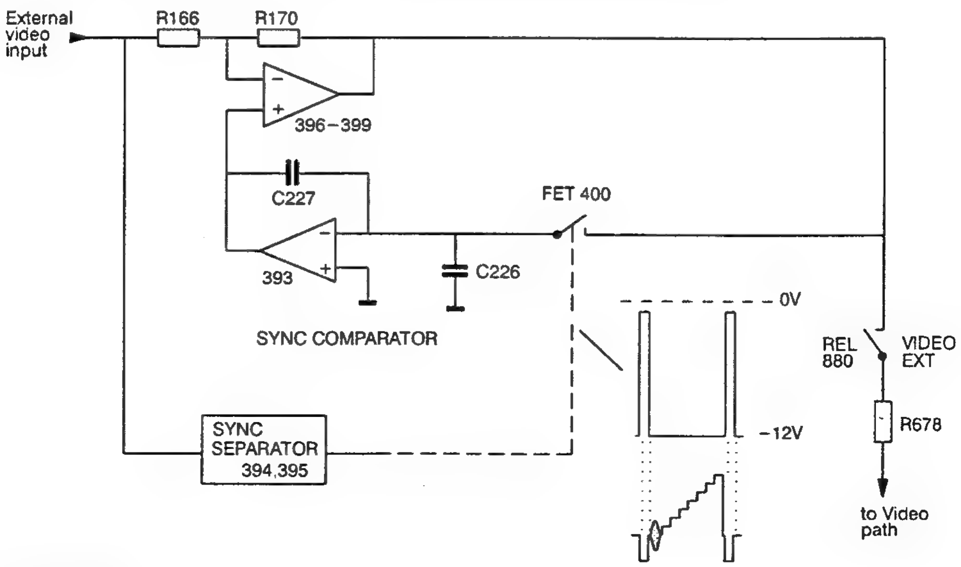
This is necessary because the NTSC system has a black level set-up of 7.5 % and the maximum amplitude must not exceed 100 %. From the output 336, 343 the CVBS signal is applied via potmeter VIDEO AMPLITUDE (601) and impedance converter 353, 354 to the VIDEO OUTPUT and the Scart connector AUDIO/VIDEO OUT. On a second path the CVBS signal is connected to video amplifier 337, 344, where the signal is inverted and dc shifted (0.14 V) for the modulation input of the RF Unit. This value corresponds to 10 % of the video peak-to-peak signal resulting in a residual carrier of –20 dB.

Switching from negative to positive vision modulation (SECAM L) is controlled by the TV System Control D331/5 by signal VIDEO/AMPL/732 (Figure 103). Depending on the selected TV system the level translator/inverter controls the four FET switches 345 to 348 which switch over the video amplifiers 337 and 338.

For all TV systems, except SECAM L, FETs 345, 347 are switched on by approximately +12 V of the level translator 350 to 352; FETs 346, 348 are turned off by –12 V. In this case a positive dc voltage at the non-inverting input of video amplifier 337 serves for a positive dc shift of 0.14 V of the CVBS signal at the output of the video path. The fourth stage operates as a voltage follower. The video signal is applied via FET 347 to its non-inverting input. The output of the video path is connected with the modulation input of the RF Unit (U10).
In the SECAM L mode FET switches 346, 348 are active while FETs 345, 347 are switched off. The video signal is shifted to negative dc value at the output of video amplifier 337, 344. The final amplifier 338, 349 serves for inverting the signal. Oscillograms of the video signal (for example greyscale pattern) are shown in the block diagram for the different amplifier stages.

The analog video path has different adjustment facilities: blanking level, amplitude chroma/luminance, multiburst and video signal applied to the RF Unit. Details of the adjustment procedure are shown in Section 8.4.

In the **external video mode** the signal output of the video preamplifier is connected by reed-relay 880 and resistor 678 to the summing input of video amplifier stage 336, 343.
The video preamplifier comprises differential amplifier 396 to 399 with current source 397, sync separator 394, 395 and sync comparator 393. Depending on the dc shift of the external video signal the sync comparator supplies a control voltage to the non-inverting input of differential amplifier 399 by which the sync level is clamped to dc zero at the output. The sync comparator operates on the principle of a sample and hold function. Sampling is achieved by FET400 during sync pulse period applied from the sync separator and hold function is realized by capacitor 226.



Video Preamplifier

4.4 DIGITAL UNIT (U1), Figures 107 to 111

The digital signals for all test patterns except the Multiburst pattern are generated by the Digital Unit (U1). The Multiburst pattern is generated by Unit 6. The digital test patterns like Center Cross, Dots, Crosshatch, and Checkerboard as well as Circle and 100 Hz Test pattern are generated by the circuitries for the Horizontal Coordinates (Z0 – Z8) and Vertical Coordinates (B0 – B8) and the pattern PROMs D114 and D125, whereby D114 is active for all TV systems with 625 lines, and D125 for 525 lines.
Detection of the first or second field for the test patterns, VPS, and Closed Caption is achieved by the Field Decoder D104A, D104B.
Selection of 16:9 or 4:3 pattern format is realized by the '16:9 ON' signal (pin 31 of D114 and D125). The different information for the 100 Hz Test pattern and Circle for odd and even fields are available at Multiplexer D116 and is selected by 'Field select'.
These patterns are selected by the Digital Pattern Control Latch D124 via the internal C-bus. The Moving-bar of the VCR Pattern is generated by D112/D113. The pattern data for the test patterns, for example Color Bar, DEM, and Greyscale are stored in the Analog Pattern Memory D209 (Figure 109) and selected by the Pattern Control Register D208.

The pattern PROMs divide the screen into eight horizontal and eight vertical bars; only some lines of the first and last horizontal bar are visible on the screen. Available test patterns and combinations depend on software version.

The digital to analog conversion of the luminance information is realized in the Luminance Summing Point on the motherboard, see Section 4.3.4. The conversion of the chrominance information takes place in the U/V-Matrix on the PAL/NTSC Unit respectively in the D'R/D'B-Matrix on the SECAM Unit.

4.4.1 Digital Unit (U1/VPS), Figures 112 to 116

The function of the Digital Unit (U1/VPS) is identical to the Digital Unit (U1) except the generation of the VPS line data and the VPS/PDC text data.
The programmable part of the VPS/PDC data is stored in the EEPROM D415. The actual VPS/PDC data to be displayed in the horizontal text bar and for VPS the data for the VPS line 16 are copied from D415 to the RAM D407 by the CPU via the I/O expanders D401 to D403. I/O expander D404 controls the read/write operations for RAM D407.
The Multiplexer D408 converts the parallel data of RAM D407 during the read operations to serial data. The 'TEXTVALIDN' (Text Valid Not) signal prepares the actual pattern for the text insertion creating a blanked horizontal bar.
The 'VPSTX' and 'TX' signals carry the text information of the blanked horizontal bar. The 'VPSTX' signal transmits the VPS line 16 data. Both signals are combined with the pattern information by gates D204A to D204C, see Figure 114. The unit has a multilayer PCB.

4.5 PAL/NTSC UNIT (U2), Figures 117 to 120

The PAL/NTSC Unit (U2) consists of a voltage controlled oscillator for four different subcarrier frequencies for the TV systems, the subcarrier coupler SAA1044, the U/V-matrix for generating color difference signals followed by a lowpass filter, the PAL/NTSC encoder TDA2501 and a switchable bandpass filter for 4.4 MHz and 3.5 MHz. For detailed information of both ICs, see Annex.

Instruments with remote control PM 5418 TXI, -TNSI or with PM 9546 have the Universal Chroma Unit (U2/IEEE) built in; it is a modified PAL/NTSC Unit. Some additional components and two additional crystals 783, 784 are mounted to generate the subcarrier frequencies for PAL M and PAL N.

The subcarrier frequencies are generated by a VCO in a Phase Locked Loop (PLL). The PLL comprises the VCO 319 with current source 320, level control circuit 306/1-3, subcarrier coupler 307 and active lowpass filter 306/5-7. According to the selected TV system the FET switches 325 to 328 are switched on by the TV system control (U11) to activate the appropriate crystals 781 to 784.

The subcarrier coupler SAA1044 (IC307) provides exact relationship between the subcarrier and horizontal scan frequencies. The FH80 signal (1.25 MHz) is applied from the sync generator SAA1043 (U11) and serves as reference. Furthermore the output signal of the subcarrier is applied to IC307 pin 7. The built-in phase comparator provides an output at PH1 which is used to control the VCO via the active lowpass filter 306/5 to 7.
To get a correct subcarrier coupling for the different TV systems the inputs X, FD and FH3 of IC307 are programmed by the TV system control (U11). Thus the subcarrier frequencies need no adjustment. Details are shown in the table below.

Standard	FD	X	FH3	Relationship of subcarrier frequency (f_S) to horizontal scan frequency (f_H)
PAL	0	1	400 Hz	$f_S = 283.7516\ f_H$
PAL N	1	1	400 Hz	$f_S = 229.2516\ f_H$
PAL M	1	0	1	$f_S = 227.25\ f_H$
NTSC	1	0	0	$f_S = 227.5\ f_H$

Positive logic: 1 = HIGH; 0 = LOW

The complete chroma data from the Digital Unit consisting of the burst signals, the vector information Q, I, U, and V, saturation signals $2^0/2^1/2^2$, G-Y = 0 and the RGB signals are applied to the U/V-matrix. These signals are weighted and summed up to generate the two color difference signals R-Y and B-Y. Both signals are fed via lowpass filter paths to the inputs 5 and 12 of the modulator circuit TDA2501. This circuit encodes the color difference signals R-Y and B-Y onto one subcarrier. Quadrature modulation allows the coding to be in accordance with either the PAL or the NTSC system. Clamping the output and correcting the out-of-balance of the modulators is done by applying the line sync pulse to input 7. In the PAL system the 0°/180° line by line phase shift of the R-Y-chroma signal part is achieved by the fH/2 signal at pin 8.

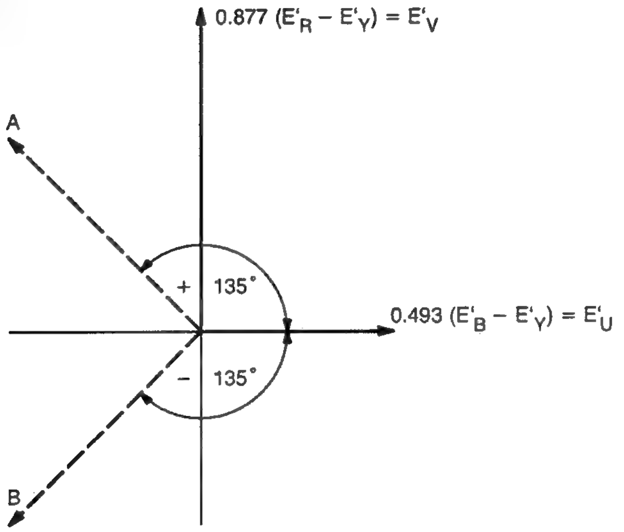
Furthermore the control signal 'PAL-G' (applied via print connector 27 and line 'a') turns on transistor 311 and relay 801 to adjust the 90°-phase shift of TDA2501 and the bandpass filter to 4.4 MHz.
The subcarrier signal generated by the subcarrier VCO is applied via transistor 322 to input 1 of the modulator circuit. To obtain a 90°-phase shift of the carrier (B-Y) the RC combination C510/R638 is used between pins 2 and 15.
Adjustment of the color difference signals (B-Y) / (R-Y) is done by trimpot R633 and the correct phase E_v to E_u is achieved by capacitor C509, see 'Table of Checks and Adjustments'.

The complete chroma signal is available at pin 9 of the modulator/encoder circuit TDA2501 and is passed via the 4.4 MHz bandpass filter via transistor 316 to the 'Chroma Out' pin 26 of the PAL/NTSC Unit. The bandpass filter suppresses the dc components of the (R-Y) + (B-Y) signal.

For the NTSC and PAL systems with 3.5 MHz subcarrier frequencies the control signal via line 'a' is not present: thus transistor 311 and relay 801 are switched off. The 90°-phase shifted carrier of TDA2501 and the bandpass filter are switched over. In this case transistor 313 is turned off, capacitor C515 is switched on by diode 404, so bandpass filter is adjusted to 3.5 MHz.

During NTSC the control signal fH/2 at pin 8 is changed to dc, thus the phase shift of the R-Y modulator is switched off to 0°.

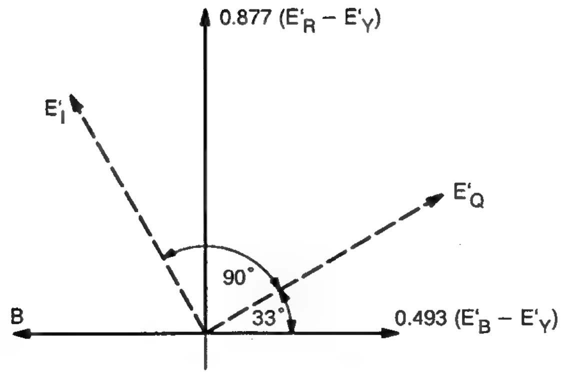
PAL Systems



A: Phase of the burst in odd lines of the first, second, fifth, and sixth fields and in even lines of the third, fourth, seventh, and eighth fields

B: Phase of the burst in even lines of the first, second, fifth and sixth fields and in odd lines of the third, fourth, seventh, and eighth fields

NTSC Systems



B: Phase of the burst

Chrominance Axes and Phase of the Burst

4.6 SECAM UNIT (U3), Figures 121, 122

The SECAM Unit consists of the FM Modulator Controller TDA2507, IC312, and the SECAM Encoder TDA2506, IC313. For detailed information of both ICs see Annex pages 12 to 16.

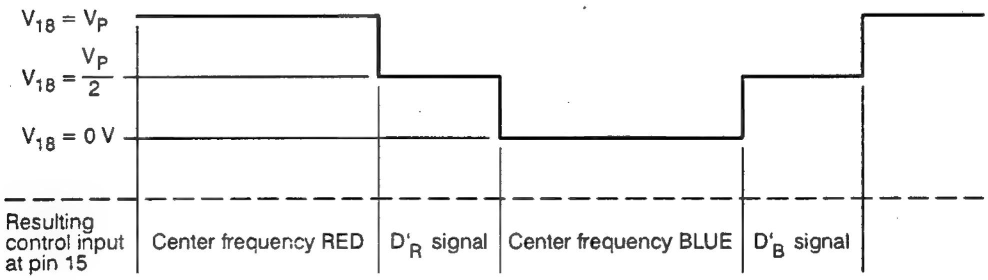
The signals from the Digital Unit at connector 108, those are the color bar as well as the '30 % color bar' and the greyscale signals, are weighted in the summing circuitry according to the SECAM system D'R = 1.9 (ER - EY) and D'B = 1.23 (EB - EY). These signals are fed to the SECAM Encoder which produces sequential, frequency modulated color signals, controlled by the clock pulse Clp, the horizontal and vertical sync pulses and the chrominance blanking (BC) signals from the sync pulse generator IC324 on the Digital Unit.

Band limitation and low-frequency pre-emphasis are achieved between pins 6 and 5 of IC313. High-frequency pre-emphasis is achieved by the 'Anti-bell Filter' and the bandpass filter between pins 23 and 3.

The FM Modulator Controller TDA2507 (IC312) generates the two subcarriers for FM modulation, which are locked to fH in two PLL circuits. The PLL filters are connected to pin 12 and pin 16. IC312 also demodulates the frequency fed from IC313 pin 23 to IC312 pin 1 and produces a control voltage depending on the center frequency of a DR- or DB-line and an active line.
The sequence is:
2 lines 4.40625 MHz - 1 line FM signal of D'R -
2 lines 4.25000 MHz - 1 line FM signal of D'B -
and so on, see figure below.

This voltage, lowpass filtered, synchronizes the FM modulator of IC313.

Instruments with remote control, PM 5418 TXI and -TNSI, have a modified SECAM Unit (U3/IEEE), see Figure 122. The SECAM DEM Pattern is different to the standard instruments. The value of resistors R641 to R645 and R612/613 are changed. Additionally the Analog Pattern PROM D209 on the Digital Unit has a special software.

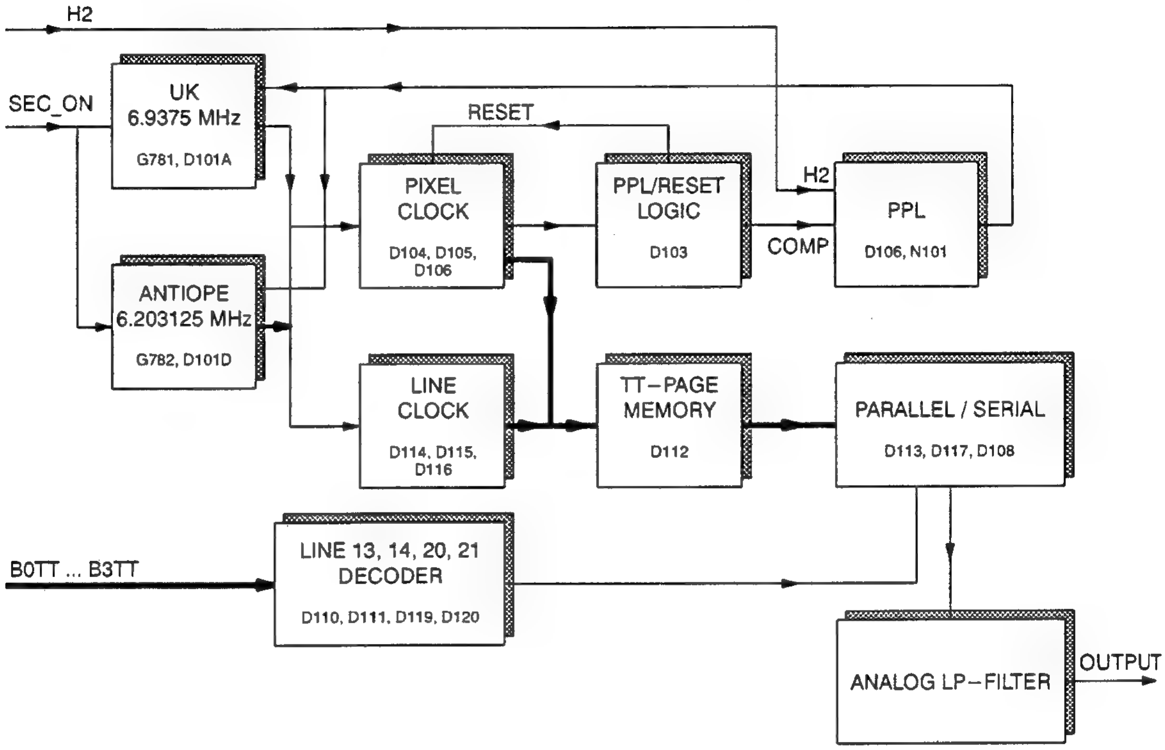


Timing Pulse Output (Pin 18) and resulting Control Input (Pin 15)

4.7 TELETEXT UNITS

4.7.1 Teletext Unit TOP/FLOF (U4), Figures 123, 124

The Teletext TOP/FLOF Unit generates UK-Teletext including TOP, FLOF/FASTEXT, and VPT functions and Didon Antiope Teletext. The contents of the Teletext pages is described in the Operating Manual, Chapter 6. The different teletext systems are selected by the thumbwheel switches for TV systems and two switches UK-TT/AUTO/ANTIOPE and TOP/FLOF on the rear panel.



Block Diagram Teletext Unit TOP/FLOF

Description of Block Diagram

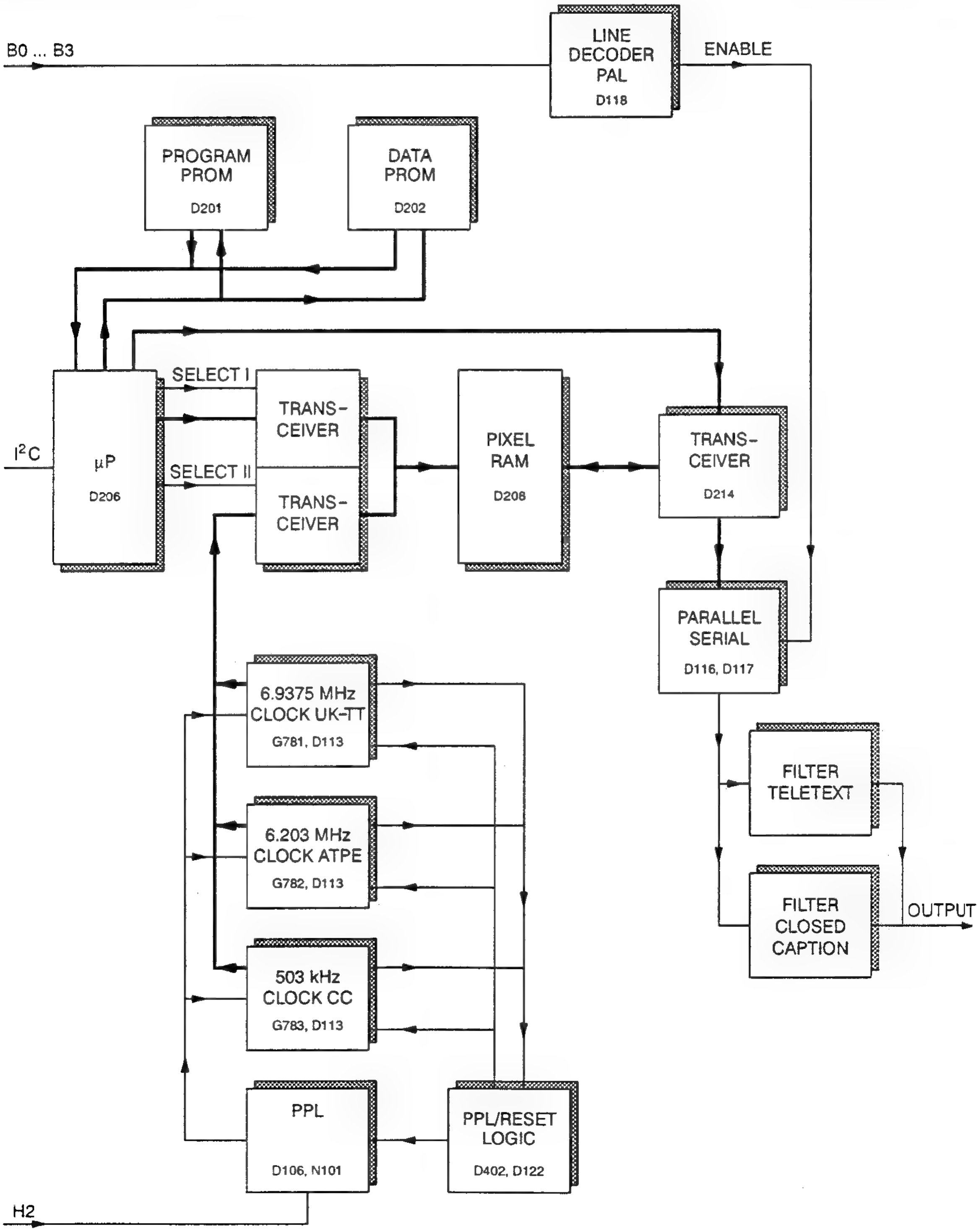
All Teletext lines are stored pixel by pixel in the TT-Page Memory, EPROM D112. The EPROM is addressed by two different counters. One counter addresses the pixels in a TV line and the other one the 24 possible Teletext lines on the screen. The pixel clock for the two different systems UK-Teletext and ANTIOPE is provided by two different crystal oscillators which are PLL locked to the line frequency (H2).
A UK-Teletext line consists of 444 bits. After these bits the pixel counter (D104, D105, D108) is reset. The counter does not start at zero but some bits before. The address range before zero in the Teletext PROM is empty because the active teletext line starts about 12 μs later than the line sync. The start address is $1B7_{hex}$ and the active part starts at address 200_{hex}. The parallel data are converted to serial (D113, D117) and are $\sin^2$-filtered by an analog lowpass filter. The teletext ANTIOPE works identical except the different start address $1C6_{hex}$ and 200_{hex} for the active line. ANTIOPE has 397 pixels per line.

The Teletext signals are sent in special lines in the vertical blanking period before the active TV picture starts. These lines are decoded by the line decoder comprising IC's D110, D119, D120. During the lines 20, 21, 333, 334 the Parallel/Serial Converter D113 is enabled.

Details for identification and levels of the teletext data lines are shown in Figures 26 and 27. The Teletext amplitude is adjustable by trimpot R128, see 'Table of Checks and Adjustments'.

4.7.2 Teletext/PDC/CC Unit (U4/PDC), Figures 125 to 128

The Teletext/PDC/CC Unit (U4/PDC) generates UK-Teletext including TOP and FLOF/FASTEXT functions, Programme Delivery Control (PDC), Didon Antiope Teletext, and Closed Caption (CC). The contents of the Teletext pages or CC data sets is described in the Operating Manual, see Chapter 7/8. The different teletext systems are selected by the thumbwheel switches for TV systems and two switches UK-TT/AUTO/ANTIOPE and TOP/FLOF on the rear panel. Closed Caption is generated only if NTSC is selected.



Block Diagram Teletext/PDC/CC Unit

Description of the Block diagram

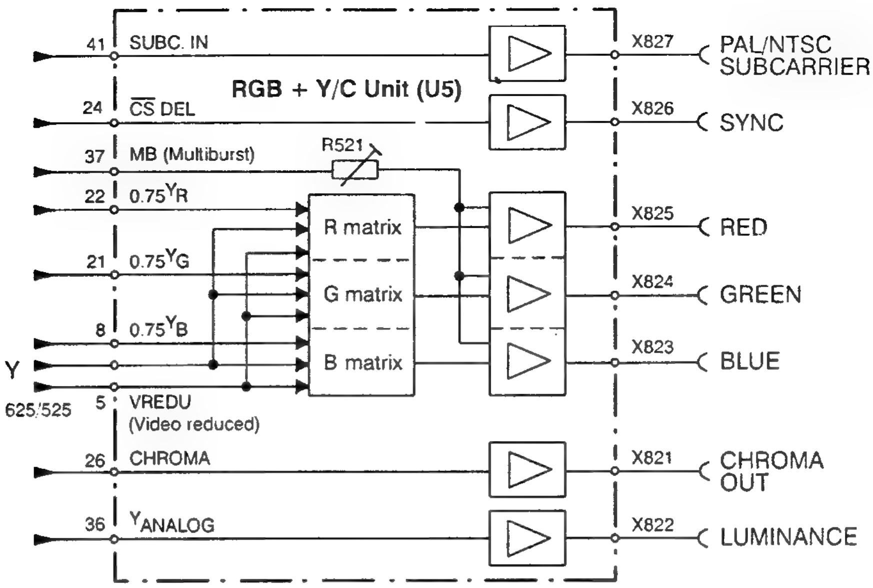
The complete Teletext and Closed Caption (CC) data are located in the data PROM D202. When the user selects a special Teletext page or CC data set the bits are copied by the Microprocessor to the RAM. In the RAM are four different lines at the same time. The RAM is addressed by two different counters. One counter addresses the pixels in a TV-line and the other one the 24 possible teletext lines on the screen. This rhythm is interrupted by the PDC and RCF (Recorder Control Function) data. The RCF data are sent every 200 ms controlled by a counter and the processor. The pixel clock and line clock are supplied by three different oscillators for the systems UK-Teletext, ANTIOPE and Closed Caption. They are locked to the line frequency by a PLL loop.
A UK-Teletext line consists of 444 bits. After these bits the pixel counter (D103, D104, D123) is to reset. The counter does not start at zero but some bits before. The address range before zero in the Teletext PROM is empty because the active Teletext line starts about 12 µs later than the line sync. The start address is $1B7_{hex}$ the active part starts at address 200_{hex}. The parallel data are serialized (D116, D117) and $\sin^2$-filtered by an analog lowpass filter.

For Closed Caption a second filter with a lower 3 dB frequency is provided. The path is switched by relay K101.
Teletext ANTIOPE works identical but with a different start address $1C6_{hex}$ and 200_{hex} for the active line. ANTIOPE has 397 pixels per line.
Closed Caption works similar to Teletext but with a different clock frequency. The start address is $1F7_{hex}$ the active CC-line starts at 200_{hex}. It consists of the clock run-in, the start bit and 16 data bits.
The UK-Teletext signals are sent in special lines in the vertical blanking period of the first and second field. These lines are decoded with IC D118. During the lines 13, 14, 20, and 21 and the according lines in the second field the PAR/SER converter D116 is enabled. For ANTIOPE only the lines 20, 21, 333, 334 are allowed.
Closed Caption data are only transmitted in the first field in line 21.

Details for identification and levels of the teletext data lines are shown in Figures 26 and 27. The Teletext amplitude for PAL/SECAM is adjustable by trimpot R123 and for NTSC by R109, see 'Table of Checks and Adjustments'. The Teletext/PDC/CC Unit is a ten layer PCB mounted with SMD components.

4.8 RGB & Y/C UNIT (U5), Figures 129, 130

For the RGB & Y/C Unit (U5) the complete luminance data are applied from the Digital Unit, U1. The five output signals R-G-B, subcarrier and sync signal are connected via coax cable to BNC connectors at the rear side. Depending on the selected TV system the subcarrier frequency and video levels are switched over. For the TV system SECAM the subcarrier output is turned off.
The luminance and chroma signals are applied separately to the Y/C output connector.



Block Diagram RGB & Y/C Unit

The **luminance data** are weighted in the three summing points RED (V101), GREEN (V201) and BLUE (V301). Control signals 'black level offset' and 'VREDU' (reduced video amplitude) are necessary for TV systems PAL/NTSC M. The luminance signal Y + 0.25 is used for PAL I only.
The single color components are applied via sin^2-filter paths (fu = 2 MHz) to the three output stages RED, GREEN, and BLUE. The filters serve for signal shaping of the leading and trailing edges especially for the crosshatch pattern (pulse width 200 ns).
The output stages consist of differential amplifiers N101, 201, 301 with current source and output amplifiers V103, V203 and V303. Z-diodes V102, V202 and V302 serve for level shift of the dc-coupled outputs. The output impedance is 75 Ω.

In order to avoid high frequency cut-off for the multiburst pattern this signal is applied separately to the output stages. Adjustment is possible by trimpot 521.
The **sync signal** '$\overline{CS}$ DEL' is fed via driver D102 and differential amplifier V541, 542 to the SYNC output. Furthermore it is possible to have the sync signal in GREEN by setting jumper X002 to ON at the PCB.

The **PAL/NTSC subcarrier** signal is applied via buffer V531 to the BNC output; amplitude: 1 V_{pp} into 75 Ω.

For the Y/C-output the **luminance signal** is applied via buffer V401, 450, and inverting feedback amplifier N401A to the Y-output. The multiburst signal is fed separately to amplifier N401A. The dc-coupled output generates a signal of 1 V_{pp} into 75 Ω.

The **chroma signal** is fed via inverting amplifier stage V511, 513 to the ac-coupled output. In the NTSC mode the gain of the luminance and chroma path are reduced by switching-over the feedback path via FETs V404 respectively V512.

For detailed checks and adjustments of this unit please follow Section 8.4. Signals and amplitudes for the different test pattern are shown in Figures 31 to 56.

4.9 MULTIBURST UNIT (U6), Figures 131 to 133

The **Multiburst Generator** comprises a counter, a summing amplifier, current sources for the subsequent triangle generator, a sine shaper and a start/stop circuit. On each TV line the circuit delivers eight packages of sine waves.

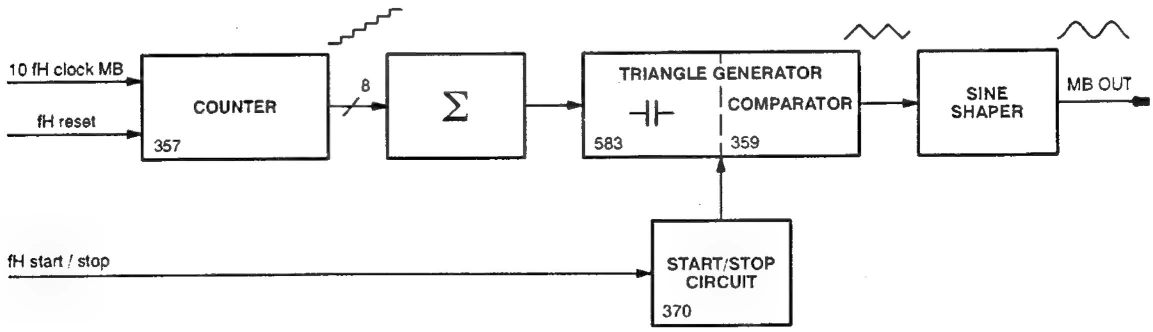
A counter with subsequent summing amplifier delivers a staircase signal which in a triangle generator is converted into packages of sinewaves with stepwise increased frequencies from 0.8 to 4.8 MHz.

The Johnson counter 357 is clocked by 10 fH and reset after each line. Depending on the status of the counter the currents through resistor 347 for 0.8 MHz multiburst frequency, 748 for 1.8 MHz to respectively 754 for 4.8 MHz are summed up in the amplifier 358 pin 2, resulting in a current through transistor 364 or 2i. Via current mirror 358 pin 10 a current 'i' is driven through transistor 372. So depending on the on/off state of transistors 365/366, controlled by comparator 359, (2i - i) = i or (0 - i) = -i is flowing through charging capacitor 583 of the triangle generator.

The reference voltage of the comparator at pins 11 and 1 is set to approximately ±1 V.
Via decoupling FET 367 the zero-symmetrical triangular wave is present at transistor 368 and converted into sine wave at the MB OUT connection 29 by the sine shaper.
The multiburst frequency, that means the charging current of the generator, is adjusted at 3 MHz by potmeter 757, see 'Table of Checks and Adjustments'.
The amplitude of the multiburst signal is set by potmeter 676 on the Motherboard U11, Figure 106.

The START/STOP MB signal is generated by the Digital Unit and applied via connector 14 to Unit 6. If the stop signal is active, transistor 370 and so diode 448 conducts, so that the output of transistor 372 a low dc-voltage (DC OFFSET) is fixed. This prevents the comparator 359 to switch over: the oscillation of the triangle generator stops.
The dc portion within the multiburst signal is set to zero by potmeter 786.

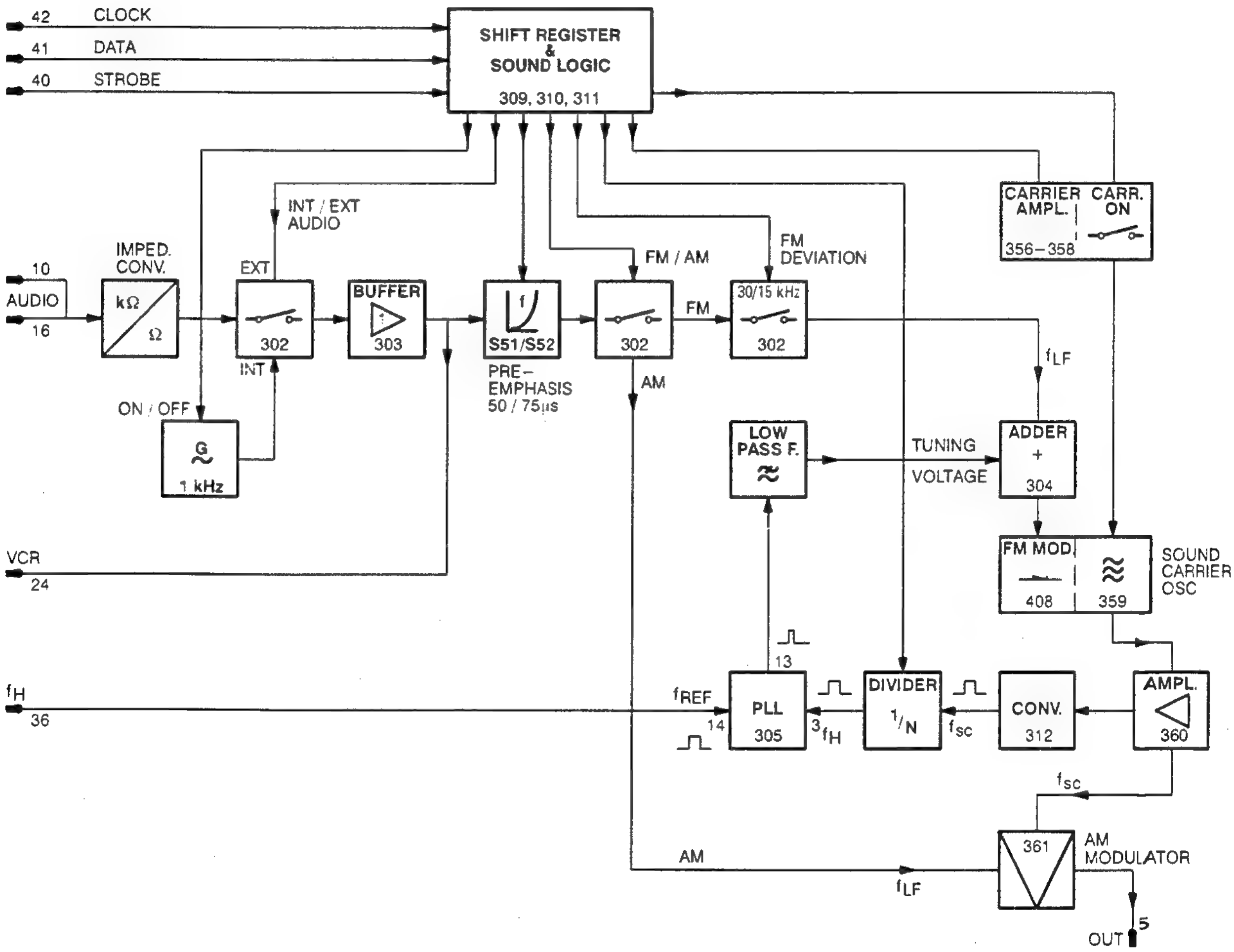
Instruments with **remote control**, versions PM 5418 TXI and -TNSI, have a modified Multiburst Unit (U6/IEEE), see Figure 133. Multiburst 1 or Multiburst 2 is selectable by a jumper on the PCB. Multiburst 1 is the standard pattern, Multiburst 2 generates a fixed 250 kHz sinewave. On the soldering side of the PCB resistors R800/801 and diode 454 are added.



4.10 SOUND UNITS

Depending on the type of instrument different sound units are built in. Standard instruments are equipped only with the Mono Sound Unit (U8). The PM 5415/PM 5418 analog stereo/dual sound versions indicated by an 'X' in the type number have two sound units: LF Stereo Sound (U7/ST) and RF Stereo Sound (U8/ST).
Instruments with NICAM sound indicated by an 'N' in the type number have two TWIN sound units: TWIN LF Unit (U7/TWIN) and TWIN RF Unit (U8/TWIN).
A complete survey of units and versions is shown in Figure 100.

4.10.1 Mono Sound Unit (U8), Figures 134, 135



Block Diagram Mono Sound Unit

The Mono Sound Unit (U8) comprises the sound logic for different TV systems, the sound oscillator (1 kHz), input circuitry for external sound signals, programmable sound carrier oscillator and the AM/FM modulator.
The CPU controls Unit 8 via C-bus lines DATA (SDA), CLOCK (SCL), and STROBE. Dependent on the chosen TV system the shift register IC309 and sound logic IC310, 311 select the sound carrier frequency, level and modulation deviation. A function table of the logic states is shown next page.

The 1 kHz oscillator is a RC oscillator based on the Wien-bridge principle, the components of which are R615, C507, R616, C508. Transistor array 301/6 to 301/8 is added for switching and decoupling the differential amplifier 301/1 to 5. Via emitter follower 301/9 to 301/11 the decoupled signal is fed to the amplitude control 401, 402, C504; so stability of oscillation and amplitude is achieved. The oscillator is turned on by transistor 354.

For external sound signals (AUDIO) the impedance converter 351, 301/12 to 301/14 is available. Internal or external sound signals are applied via selectable pre-emphasis (50 µs or 75 µs, dependent on TV system) and multiplexer 302 to the FM-modulator, for system SECAM L to the AM-modulator. By means of solder links S51 and S52 the pre-emphasis can be switched off separately. Solder links must not be open.

The sound carrier is generated by a voltage controlled oscillator (VCO) turned on by transistor 357. The carrier frequency depends on the selected TV system (4.5, 5.5, 6.0, or 6.5 MHz) controlled in a Phase Locked Loop (PLL). The sound carrier amplitude is altered for TV systems PAL/NTSC M and PAL N by transistor 356.
In the loop the carrier signal fsc is fed via amplifier 360, converter 312 to the programmable divider IC306 to IC308 to divide-down to the line frequency, see table next page. This signal is compared by the PLL-circuit IC305 with the line frequency fH which serves as reference, generated by the sync pulse generator SAA1043 (U11). IC305 generates a control voltage which is applied via a lowpass filter, adder 304 to varicap 408 to tune the VCO. After switching on the sound carrier it lasts some seconds until the frequency has settled.

For FM modulation the audio signal is fed via adder stage 304 to varicaps 408. For SECAM L the sound modulation is switched over to AM. In this case the audio signal is applied via path AM, amplifier 363, to the AM modulator 361.

Function Table Shift Register and Sound Logic IC309 to IC311, Mono Sound Unit

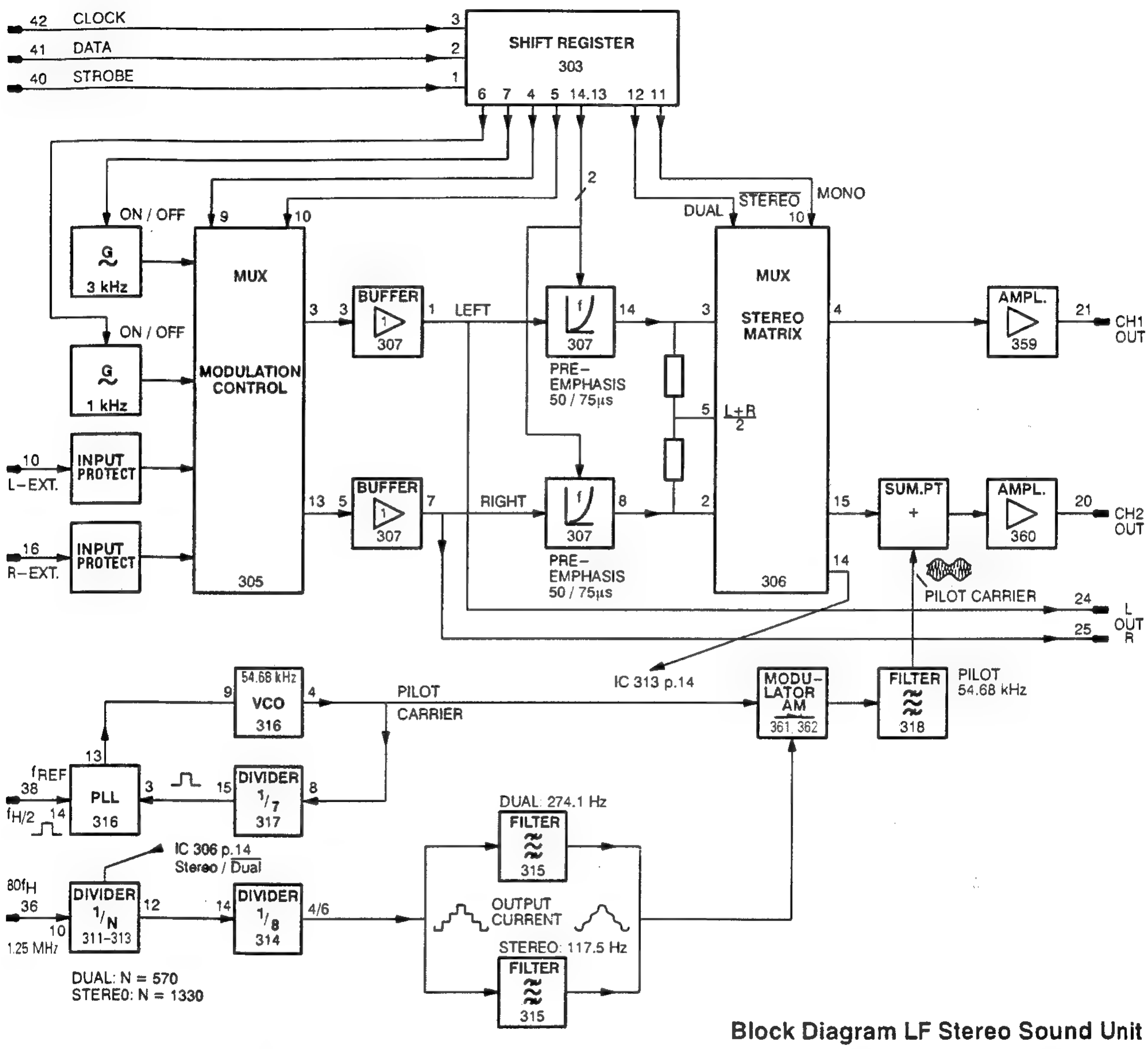
IC309	TV System PAL					NTSC		SECAM			
Pin No.	**G**	**D**	**I**	**M**	**N**	**NTSC**	**NTSC 4.43**	**B,G,H**	**D,K**	**L**	**Function**
4	H	H	H	H	H	H	H	H	H	H	Carrier ON
5	L	L	H	L	L	L	L	L	L	L	
6	H	L	L	L	L	L	L	H	L	L	
7	L	L	L	L	H	L	L	L	L	L	
11	H	H	H	H	H	H	H	H	H	H	INT/$\overline{\text{EXT}}$
12	H	H	H	H	H	H	H	H	H	H	INT ON/OFF
13	L	L	L	L	L	L	L	L	L	H	AM/$\overline{\text{FM}}$
14	L	L	L	H	L	H	H	L	L	L	
IC310 Pin No.											
4	H	H	L	H	H	H	H	H	H	H	Divider
10	L	H	L	H	H	H	H	L	H	H	Divider
IC311 Pin No.											
3	L	L	L	H	H	H	H	L	L	L	
10	H	L	H	L	H	L	L	H	L	L	Divider
11	L	L	L	H	H	H	H	L	L	H	Pre-emphasis

Function Table Sound Carrier Oscillator/PLL, Mono Sound Unit

TV		IC307, Pin No.				IC308	IC306	Total
System	**Frequency**	**3**	**4**	**5**	**N**	**Pin 3**	**N1**	**N**
G, B, H	5.5 MHz	H	L	H	11	L	32	352
D, K, L	6.5 MHz	H	H	L	13	L	32	416
I	6.0 MHz	L	L	H	12	L	32	384
M	4.5 MHz	H	H	L	13	H	22	286
N	4.5 MHz	H	H	H	9	L	32	288
NTSC	4.5 MHz	H	H	L	13	H	22	286
NTSC 4.43	4.5 MHz	H	H	L	13	H	22	286

4.10.2 Analog Stereo Sound Units U7/ST and U8/ST

4.10.2.1 LF STEREO SOUND UNIT (U7/ST), FIGURES 136, 137



Block Diagram LF Stereo Sound Unit

Depending on the selected sound mode Unit 7/ST generates the audio frequencies 1 kHz and 3 kHz as well as the pilot carrier 54.68 kHz and two identification frequencies 274.1 Hz/117.5 Hz in the DUAL/ STEREO mode. The line frequency serves as reference. The Dual and Stereo mode are only possible if the instrument is set to the TV system PAL G. The different sound modes are controlled from the CPU via C-bus lines DATA (SDA), CLOCK (SCL), and STROBE by the shift register 303, see function table on the next page.

The internal audio frequencies 1 kHz and 3 kHz are generated by two RC oscillators based on the Wien-bridge principle. The 1 kHz oscillator is switched on by transistor 354 while array 301/6 to 301/8 serves for decoupling the differential amplifier 301/1 to 301/5. Via emitter-follower 301/9 to 301/11 the signal is applied to amplitude control 401, 402, C504; so stability of frequency and amplitude is achieved.

The 3 kHz oscillator is switched on by transistor 351. Components and circuitry are almost identical to the 1 kHz oscillator.

In the mono sound mode the 1 kHz or 3 kHz signal is applied to channel 1 via modulation control switch 305, buffer 307, pre-emphasis, stereo matrix 306, output stage 359 to the output CH1. Furthermore the internal 1 kHz or 3 kHz signal is available at the Scart output connector.

For external sound modulation the signal is applied via the AUDIO input connector to the modulation control switch 305. Input protection is done by Z-diodes 405, 406, and 410, 411.

In the stereo sound mode both audio signals are applied via modulation control switch 305 to the left channel (CH1) and the right channel (CH2). For channel 1 the stereo matrix 306 delivers the sound signal (L+R): 2 via resistors 651, 652. For channel 2 the modulated pilot carrier is added to the audio signal at output amplifier 360.

In the stereo/dual sound mode the 54.6875 kHz pilot carrier frequency (3.5 x fH) is generated in a phase locked loop (PLL) by circuit 316 and divider 317 (N = 7). This signal is compared with the reference frequency fH/2 by the PLL circuit. The pilot carrier is fed via resistor 687 to the AM modulator 361, 362.
Furthermore the 117.5 Hz and 274.1 Hz identification frequencies are realized by dividing down the signal 80fH = 1.25 MHz by IC311 to 314. Signal 80fH is generated by the sync pulse generator SAA 1043 (U11). In stereo mode the division ratio is set to N = 1330 for IC311 to 313 and N = 8 for IC314. In the dual mode the programmable divider 311 to 313 is switched over to N = 570 by the stereo matrix 306 pin 14. The identification signals are applied via active filters 315 to the AM modulator.

Function Table Shift Register IC303, LF Stereo Sound Unit

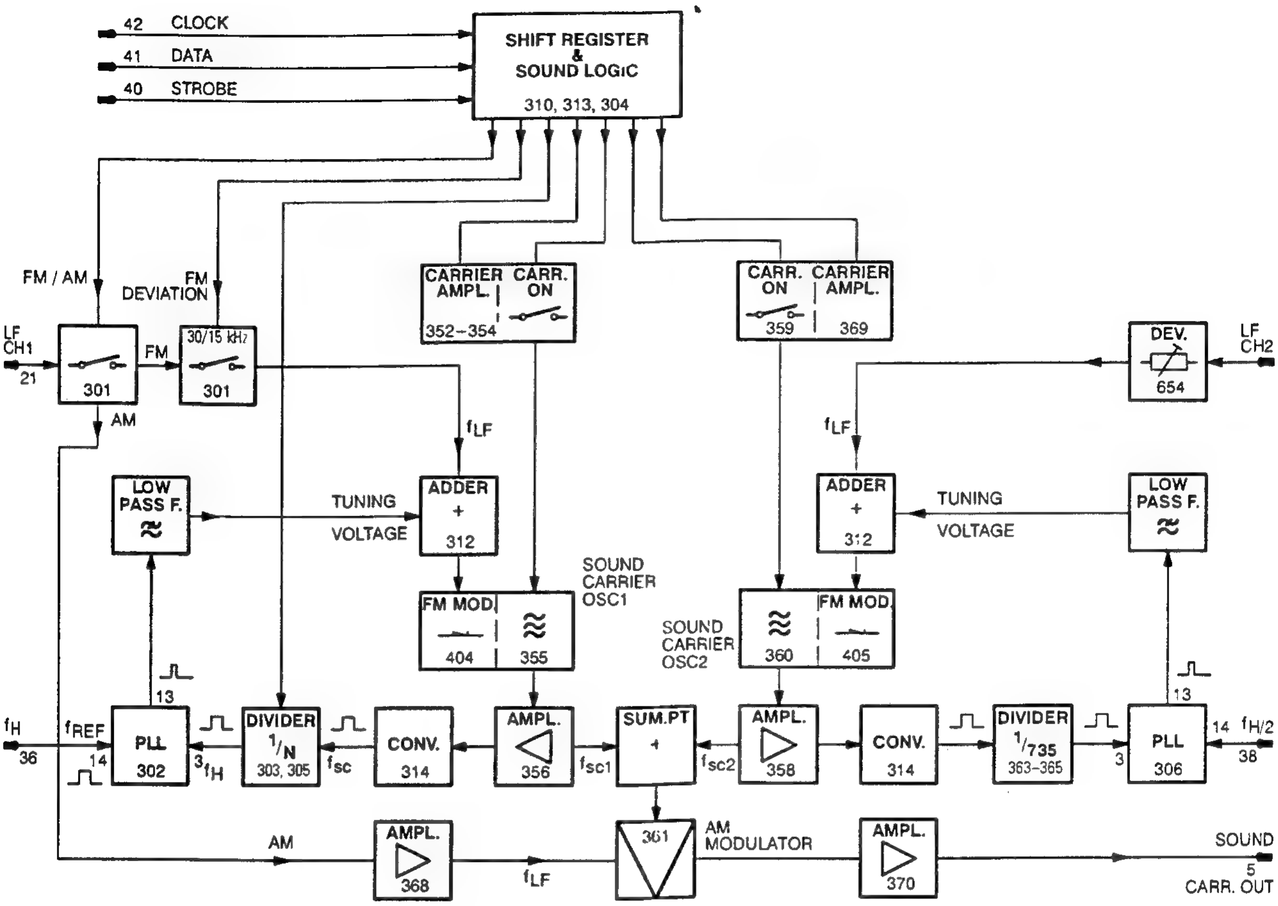
IC303	TV SYSTEM						Function
	PAL		NTSC		SECAM		
Pin No.	G,D,I	M,N	M	4.43	B,G,H,K	L	
13	H	L	L	H	H	L	Pre-emphasis
14	L	H	H	L	L	L	50 µs/75 µs

Pin No.	1 kHz ON/$\overline{\text{OFF}}$	3 kHz ON/$\overline{\text{OFF}}$	Remarks
6	H	–	Sound
7	–	H	Oscillators

Pin No. 4	5	6	1 kHz L	3 kHz L	1 kHz R	Remarks
L	L	H	–	x	x	left and
L	H	H	x	–	x	right
H	L	H	x	–	–	channel
L	L	L	–	x	–	
H	H	L	external sound modulation			

Pin No.	MONO	DUAL	STEREO	Remarks
11	H	L	L	Stereo matrix
12	H	H	L	Modulation pilot carrier

4.10.2.2 RF STEREO SOUND UNIT (U8/ST), FIGURES 138, 139



Block Diagram RF Stereo Sound Unit

In general the RF Stereo Sound Unit (U8/ST) comprises the same circuitries as the Mono Sound Unit 8 (see Section 4.10.1) and generates the sound carrier 1 frequencies 4.5/5.5/6, and 6.5 MHz according to the different selected TV systems. The second sound carrier frequency is only generated if PAL G is selected. The audio oscillators for 1 kHz and 3 kHz, and the pre-emphasis are located on the LF Stereo Sound Unit (U7/ST).

Unit 8/ST is controlled from the CPU via the C-bus lines DATA (SDA), CLOCK (SCL), and STROBE. Dependent on the chosen TV system shift register IC310 and sound logic IC313 select frequencies for sound carrier 1, modulation and carrier level. Sound carrier 2 is controlled by IC304 and transistor 369. A function table of the circuit is shown on the next page.

The sound carrier 2 frequency 5.742 MHz is generated in a Phase Locked Loop (PLL) by VC02 if the instrument is switched to DUAL or STEREO. For the PLL the carrier signal is applied via amplifier 358, converter IC314 to the programmable divider IC363 to 365 to divide down to half the line frequency (N = 735). This signal is compared in the PLL circuit 306 with the reference frequency fH/2, generated by the sync pulse generator, SAA1043 (U11). IC306 generates a control voltage at the output pin 13 which is applied via a lowpass filter, summing amplifier 312 to varicap 405 to tune the VC02. For FM modulation the audio signal is fed via input 'LF CH2', summing amplifier 312 to the varicap 405 of VC02.

Sound carrier 1 and 2 are summed up at resistors 655, 656, applied via the output amplifiers 361 and 370 to the RF Unit 10.
For SECAM L the audio signal is applied via the AM path, amplifier 368 to the output amplifier which acts as AM modulator.
Further frequencies, for example the sound carrier 2 frequency 6.742 MHz, are prepared (lines E and D) but are not activated by the standard software.

A rough check of the stereo/dual sound function is possible by a TV including stereo sound facilities. For accurate adjustment of deviation sound carrier 2 and minimum cross-talk of the two channels special test equipment is necessary, for example R&S Stereo Demodulator AMF 2.

Function Table Shift Register IC310 and Sound Logic IC 304, 313

IC310	TV System PAL					NTSC		SECAM			
Pin No.	G	D	I	M	N	NTSC	NTSC 4.43	B,G,H	D,K	L	Function
4	H	H	L	H	H	H	H	H	H	H	
5	L	L	H	L	L	L	L	L	L	L	
6	H	L	L	L	L	L	L	H	L	L	
7	L	L	L	L	H	L	L	L	L	L	
11	L	H	L	H	H	H	H	L	H	H	
12	H	H	H	H	H	H	H	H	H	H	Carrier 2 ON/$\overline{\text{OFF}}$
13	L	L	L	L	L	L	L	L	L	H	AM/$\overline{\text{FM}}$
14	L	L	L	H	L	H	H	L	L	L	
IC304 Pin No.											
12	L	L	L	L	L	L	L	L	L	L	
IC313 Pin No.											
3	H	H	H	H	H	H	H	H	H	H	Carrier 1 ON/$\overline{\text{OFF}}$
4	H	L	H	L	H	L	L	H	L	L	
11	L	L	L	H	H	H	H	L	L	L	

Function Table Sound Carrier 1 Oscillator, RF Stereo Unit 8/ST

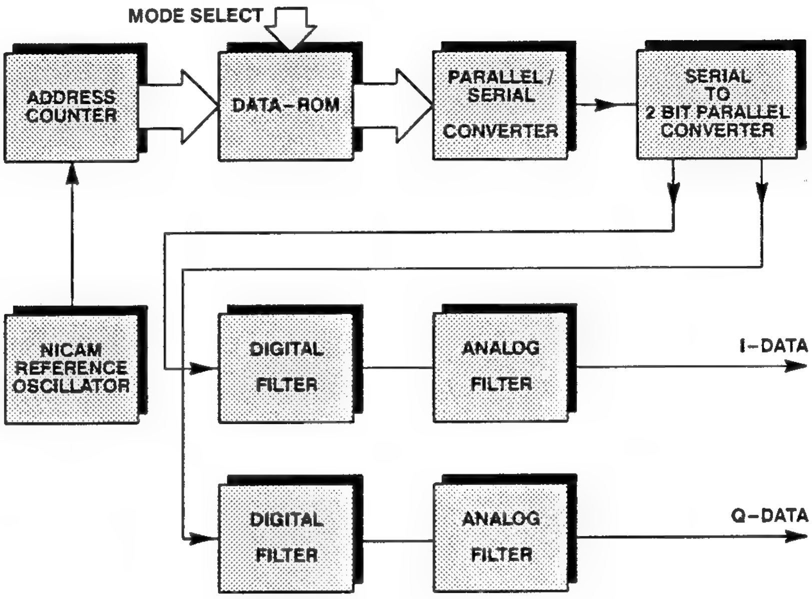
TV System	Frequency	IC305, Pin No. 3	4	5	N	IC304 Pin 3	IC303 N1	Total N
G, B, H	5.5 MHz	H	L	H	11	L	32	352
D,K,L	6.5 MHz	H	H	L	13	L	32	416
I	6.0 MHz	L	L	H	12	L	32	384
M	4.5 MHz	H	H	L	13	H	22	286
N	4.5 MHz	H	H	H	9	L	32	288
NTSC	4.5 MHz	H	H	L	13	H	22	286
NTSC 4.43	4.5 MHz	H	H	L	13	H	22	286

4.10.3 NICAM Sound

Instruments with NICAM sound indicated by an 'N' in the type number have two TWIN sound units: TWIN LF Unit (U7/TWIN) and TWIN RF Unit (U8/TWIN). These Units generate three sound modes: analog Mono Sound, Dual/Stereo Sound, and digital NICAM Sound. The generation of the analog sound modes is similar to the Mono Sound Unit or the analog Stereo Sound Units.
The TWIN Units have a multilayer PCB with mounted SMD components.

4.10.3.1 TWIN LF UNIT (U7/TWIN)

NICAM Sound



Block Diagram NICAM Sound, Unit 7/TWIN, Part 1

NICAM 728 works by alternately sampling the left and right channel signals at a frequency of 32 kHz, with a resolution of 14 bits per sample. These values are compressed to 10 bits. A parity bit is added which includes error-protection function and a code that tells how much the signal has been compressed.
The NICAM data are sent in 16 frames per 728 bits, resulting in 11648-bit information. One frame contains 704 bits for the sound and 24 bits for control and data signals (Frame Alignment Word, FAW).
A complete frame lasts 1 ms, hence the overall bit rate is 728 kbit/s.
For error protection the NICAM data are interleaved and scrambled to get a more even energy dispersal.
For transmission the serial data are converted into a two-bit parallel form. Each input pair (I- and Q-data) then determines the phase of the transmitted carrier whereby the carrier phase can assume one of 4 rest states, separated by 90°, called differential quadrature phase-shift keyed modulation (DQPSK or 4-QPSK).

For generation of subdivided frequencies a PLL circuitry is used to generate the reference frequency 5.824 MHz.
About 60 data sets for the different NICAM sound modes are stored in a sound-data PROM (OT-PROM). Mode selection is achieved by the CPU via internal bus lines SCL and SDA. Sound data are read out by an address counter from the PROM and converted from parallel to serial form. Afterwards these data are converted into two-bit parallel data streams whereby one contains the even and the second one the odd bits. In the following two paths the sound data (I and Q) are fed to digital and analog filters. The final I- and Q-data are applied via buffers to the 4-QPSK modulator of the TWIN RF Unit (U8/TWIN).

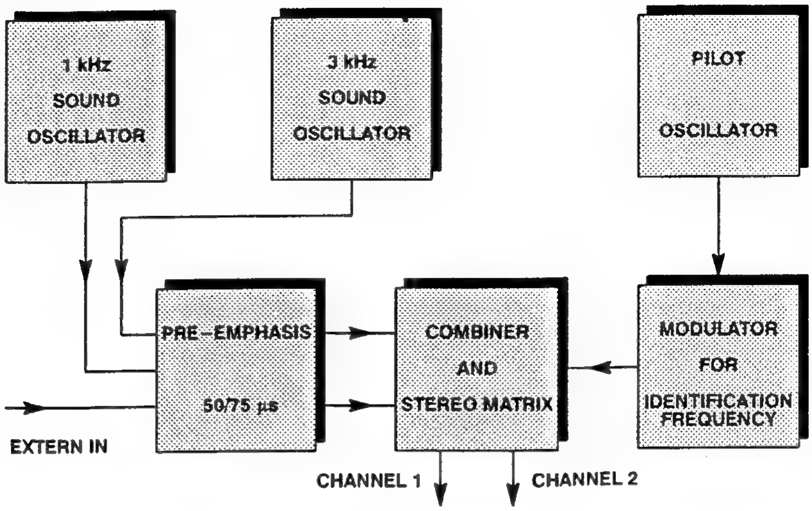
NICAM Sound, Circuit Description, Figure 140, 141

The NICAM sound is controlled by a bus expander D101 via the internal I^2C-bus lines Serial Clock (SCL) and Serial Data (SDA). The control lines of D101 are S0 to S7.
The **NICAM reference frequency** is generated by a crystal oscillator D203, controlled in a phase locked loop (PLL). The reference oscillator is controlled by C-bus lines SDA, SDC and STROBE. The PLL is locked to signal FH80 (1.25 MHz) of the sync pulse generator (motherboard). Frequency adjustment of the crystal oscillator is achieved by a tuning voltage >2 V and <10 V which is fed from the lowpass filter N201-A to varicap V201. The output frequency 5.824 MHz is applied via amplifier D203-D to divider D102-A to get all necessary subfrequencies F/2, F/4, F/8 and F/16 by division.
The subfrequency F/8 is applied to the **address counter** (1457 byte) which addresses the sound data PROM D106 via outputs A03 to A13. Addresses A00 to A03 are applied to converter D107 to convert NICAM data from parallel to serial form. The address counter is reset by a pulse derived from D103-A pin 6 when a NICAM cycle of 11648 bits or 1456 bytes is finished.

The serial NICAM data are synchronized to frequency F/8 and F by flip-flops D108-A and D108-B. In the next step the serial NICAM data are split up into two parallel data streams with half the bit rate (flip-flop D109-A, D109-B and D111), whereby one path contains the even and the second one the odd bits. Then the NICAM data pass a **phase difference encoder** comprising hex flip-flop D110, ex-or gate D112 and adder D111. The resulting data streams are called I- and Q-data.

The I- and Q data streams are passed through the **digital filters** D402, D502 to get a certain spectrum shaping (cosine roll-off). The required data are loaded in the filter PROMs and read out by 8-times oversampling (F4, F8, F16). The 8-bit coded values for the amplitude are latched by D403, D503 and then converted to analog by DACs N401, N501. The following analog filter suppresses sampling frequencies and adds 5 Volts dc.
To get a different spectrum shaping for the TV systems PAL I or PAL G the filter-PROMS are switched over by line S7 (pin 24).
For the analog FM sound the digital filters generate a constant byte sequence, so the QPSK modulators on the TWIN RF Unit cannot switchover. For this purpose the input S0 (pin 27) is switched over.

Analog LF Sound Generation



Block Diagram LF Sound, Unit 7/TWIN, Part 2

In the TWIN LF Unit the analog audio frequencies 1 kHz, 3 kHz as well as the pilot carrier 54.68 kHz and the identification frequencies 274.1 Hz, 117.5 Hz are generated. The sound signals are applied via sections pre-emphasis and combiner/stereo matrix to the sound channels 1 and 2.
The audio frequencies and the pilot carrier are generated by Phase Locked Loops (PLL), the identification frequencies by dividing down the fH80 signal (1.25 MHz) derived from the sync pulse generator (motherboard). The unit is controlled via bus expander D103 lines S0 to S7 from the CPU, see function table next page.

Analog LF Sound, Circuit Description, Figures 143, 144

The audio frequency 1 kHz is generated in a PLL circuitry comprising PLL comparator D102, lowpass filter N101, Wien-bridge oscillator N102, a frequency control path (N102-B/D, D101-B) and amplitude control path (N103-A, N103-B). The PLL is locked to 1 kHz reference frequency generated by the NICAM unit.
In the Wien-bridge oscillator the frequency determining components are capacitors C109, C110 and resistors R101, R102, R110 as well as FET V102. The FET serves as variable resistor adjusted by a tuning voltage derived from lowpass filter N101. In the PLL comparator D102-A the generated 1 kHz and the 1 kHz reference frequency are compared; before both frequencies are divided down to 500 Hz. In inphase condition short pulses are generated at its output 'PC2 out' which are integrated by the following lowpass filter (N101-A including components) to give a tuning voltage for the Wien-bridge oscillator. In addition the amplitude of the oscillator is kept constant in a control loop. The 1 kHz signal is rectified by N103-A and diode V401. The resulting dc voltage is smoothed by lowpass filter N103-B and applied to FET V103 to vary the amplification of OP N102-A.

The **3 kHz oscillator** works in the same way except an additional divider D204 is needed (divides by 6) to get 500 Hz for the PLL comparator N206. The 1 kHz and 3 kHz oscillators are in continuous operation and are switched by MUX 113A to sound channels 1 and 2.
The internal or external modulation source is switched over by multiplexer D401 controlled by the CPU and bus expander D103 via lines S2, S3. The external inputs are ac coupled and are protected against high input voltages by Z-diodes V401 to V404.
The sound signals are decoupled by OP N401A, N401B and applied to the SCART output connector (impedance 1 kΩ).

The **pre-emphasis** is achieved by OP N401C, N401D and switched over to 50 µs or 75 µs by control lines S4, S5 depending on selected TV system. Multiplexer D402A represents the **stereo matrix** generating the signals L, R, (L+R)/2. The different modes are controlled from the bus expander D103 lines S6, S7.
In the output path of channel 2 the pilot carrier is added to the summing point V413. Identification frequencies are AM modulated upon the pilot carrier depending on selected sound modes.

The **pilot carrier** of 54.68 kHz is generated by the PLL circuit D107. An internal oscillator of D107 is locked to the reference frequency fH80 (1.25 MHz). Both identification frequencies, for DUAL 274.1 Hz and STEREO 117.5 Hz, are generated by dividing down the fH80 frequency (divider chain D109, D111, and D112). A Johnson-counter D112A generates a staircase signal which is passed to active filters N301A and N301B. These filters are controlled by lines S7 and S/D. In transistor stage V301, V302 the identification frequencies are AM modulated upon the pilot carrier and filtered by bandpass N302A to suppress modulated harmonic contents.

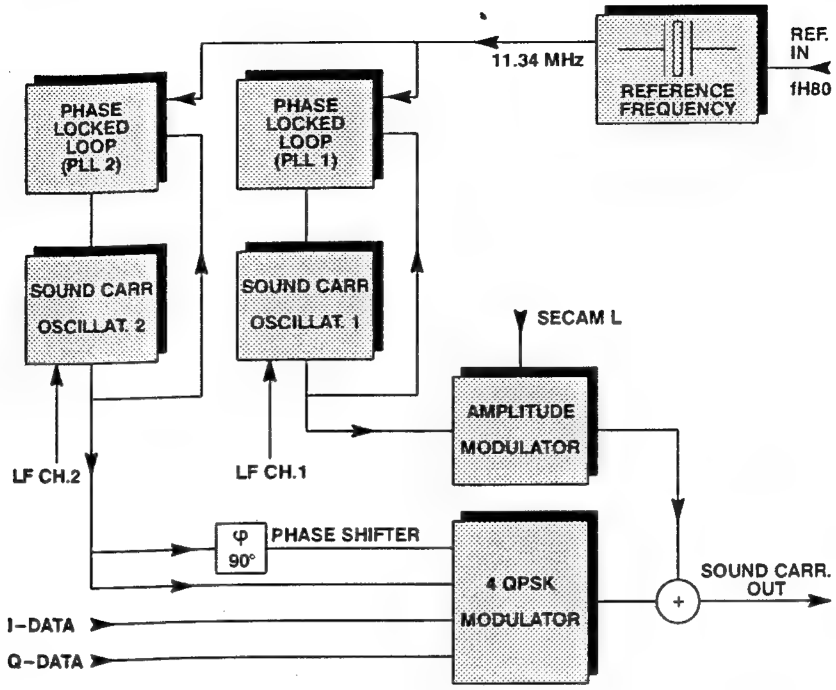
Both sound output channels 'CH1' and 'CH2' are connected to the modulation inputs of the TWIN RF Unit.

Function and Logic Table Bus Expander D103

Control Lines	Function	TV System; Remarks
S0	sound 1 kHz on	
S1	sound 3 kHz on	
S2	frequency assignment Bit 0 ⋆	⋆ see table below
S3	frequency assignment Bit 1 ⋆	
S4	pre-emphasis 50 µs	PAL/SECAM B,D,G,H,I,K,K1
S5	pre-emphasis 75 µs	PAL M,N / NTSC M
		SECAM L: S4 + S5 = 0
S6	MONO on	
S7	DUAL on	STEREO mode: S6 + S7 = 0

Frequency Assignment		
Bit 1	**Bit 0**	**Instrument Setting**
0	0	3 kHz left / 1 kHz right
0	1	1 kHz left / 1 kHz right
1	0	1 kHz left
1	1	external modulation

4.10.3.2 TWIN RF UNIT (U8/TWIN)



Block Diagram TWIN RF Unit

In the TWIN RF Unit a reference frequency of 11.34 MHz and two sound carriers are generated by Phase Locked Loops (PLL). The reference frequency is synchronized by the signal fH80 applied from the sync pulse generator (motherboard).
In the three phase control loops (reference, sound carrier 1, and 2) programmable PLL circuits of type MC145145 are used which are controlled by shift registers from the CPU. Because of only one strobe line (STR) shift registers D301, D201, and D101 are switched in series. Depending on the selected TV system the carrier frequencies are switched over.
Furthermore FM/AM modulation of the sound carrier 1 and FM or 4-QPSK modulation for the NICAM mode of sound carrier 2 are realized by this unit.

Reference Frequency Oscillator, Figure 146

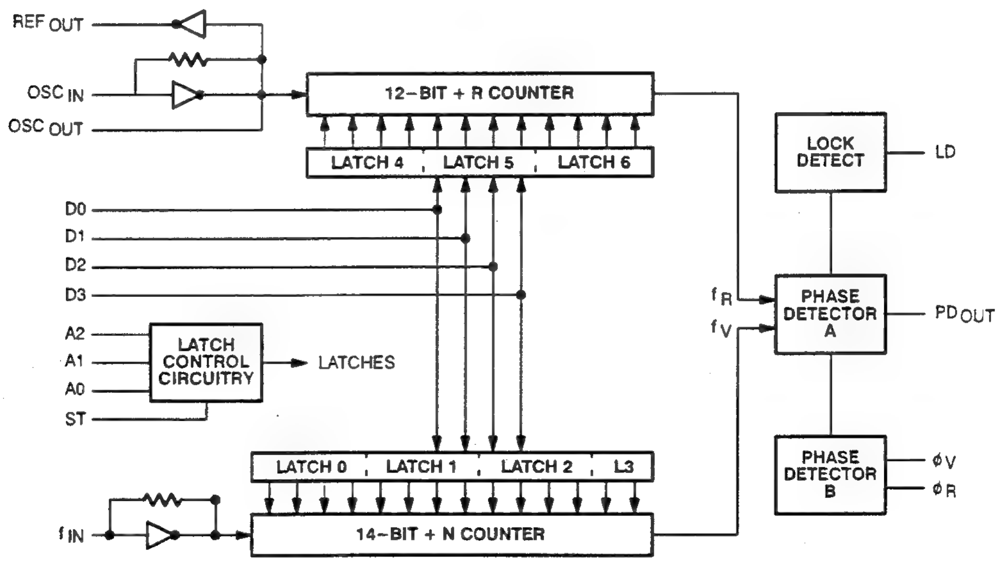
The reference frequency 11.34 MHz is generated in a PLL circuitry comprising the PLL circuit D302 and loop filter N301. For synchronizing to the master clock of the instrument signal fH80 of the sync pulse generator is applied to input f(in) of D302. For frequency adjustment of the PLL a tuning voltage is fed from the output of loop filter N301 to the varicap V302. A coax cable at the output of the PLL serves for noise suppression. The PLL is controlled via internal C-bus lines SDA, SCL and STR, and shift register D301 from the CPU. Furthermore different control signals for the Unit 8 TWIN are generated by bus expander D303. Details for the different sound modes of control lines A - H are shown in the table, Figure 146.

Sound Carrier 1, Figure 147

The sound carrier 1 frequencies 4.5 / 5.5 / 6.0 and 6.5 MHz are generated by a PLL circuitry comprising of a Voltage Controlled Oscillator VCO1, lowpass filter N101 and PLL synthesizer D102. Frequency setting is controlled from the CPU via C-bus lines DAT1, clock (SCL) and strobe (STR), shift register D101 and PLL circuit D102. fREF = 11.34 MHz serves for reference of sound carrier 1 applied to input OSCin of the PLL circuit. D102 compares the carrier 1 frequencies (fSC1) generated by VCO1 with fREF and supplies a tuning voltage at its phase detector output (PDout). In D102 the required division factors for the internal frequency comparison are reprogrammed according to the set sound carrier frequency related to the TV system. The tuning voltage is smoothed by lowpass filter N101 and applied to varicap V108 of the VCO.

Depending on selected TV system the carrier amplitude is controlled via lines A and B from bus expander D303, see Figure 146. Sound carrier 1 amplitude is adjustable by trimpot R121.

The AM/FM modulation path is switched over by MUX D103. For FM the sound signal (LF-CH1) is passed via MUX D103 pin 4/3 to the differential input of OP N101, hence the modulation voltage is superimposed to the tuning voltage applied to varicap V108 of the VCO. The deviation is adjustable by trimpot R103. The modulated carrier 1 signal is fed via amplifier V111 and buffer V112 to the RF Unit 10.
For SECAM L (only PM 5418) sound carrier 1 is AM modulated. The sound signal LF is passed via MUX D103 pin 5, buffer V101 to the emitter of the AM modulator stage V111.



Block Diagram, PLL Synthesizer MC 145145

Sound Carrier 2, Figure 148

The sound carrier 2 frequencies 5.742 MHz, 5.850 MHz, and 6.552 MHz are generated by a PLL circuitry comprising of a Voltage Controlled Oscillator VCO2, lowpass filter N101, and PLL synthesizer D202.
Frequency setting is controlled from the CPU via C-bus lines DAT2, clock (SCL) and strobe (STR), shift register D201, and PLL circuit D202. 11.34 MHz (fREF) serves for reference of sound carrier 2 applied to input (OSCin) of the PLL circuit. D202 compares the carrier 2 frequencies (fSC2) generated by VCO2 with 11.34 MHz and supplies a tuning voltage at its phase detector output (PDout). In D202 the required division factors for the internal frequency comparison are reprogrammed according to the sound carrier frequency related to the selected TV system. The tuning voltage is smoothed by lowpass filter N101 and applied to varicap V208 of the VCO. For PAL I the carrier and amplitude are controlled via line D and for PAL B/G/H via line E by the bus expander D303, see Figure 146. Sound carrier 2 amplitude is adjustable by trimpot R221.
For DUAL and analog STEREO the sound signal (LF CH2) is passed via MUX D203 pin 5/4 to differential input of OP N101; the modulation voltage is superimposed on the tuning voltage applied to varicap V208 of the VCO2 (frequency modulation).
The deviation is adjusted by trimpot R201 to minimum crosstalk of left to right channel in STEREO mode.
In the FM modulation modes of sound carrier 2 (TV system B/G) the I- and Q-DATA lines of the 4-QPSK modulator are set to 6 V. The modulated carrier signal from VCO2 is applied via transistors V211/212 or V210/214, modulator N202/203 to the output SC2; the FM carrier is transferred by N202/N203 with constant amplitude and phase.

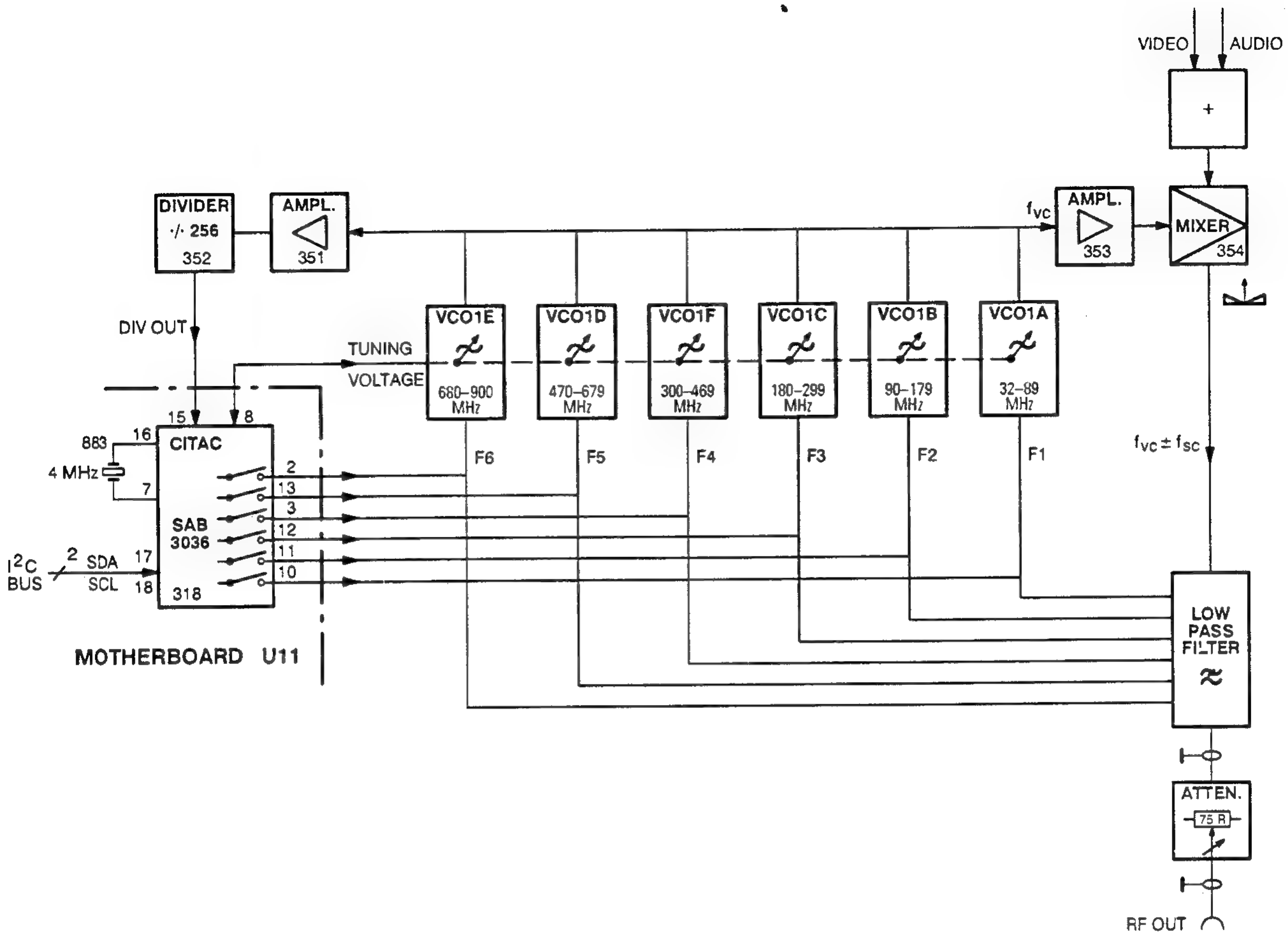
In NICAM mode the sound carrier is modulated digitally. For transmission the serial NICAM data are converted into two-bit parallel form. Each input-bit pair then determines the phase of the carrier. The carrier phase can assume one of four rest states separated by 90°. Each bit pair shifts the phase of the carrier by a designed amount, with the reference to the previous rest-state. This principle is called differentially encoded quadrature phase shift keying (4-QPSK).

Quadrature modulation is realized by two 4-quadrant multiplier circuits of type MC 1496 where the phase position of two orthogonal sound carrier signals are shifted by 0° or 180° and added. For this purpose the generated VCO2 signal is split into two paths. In the upper path the sound carrier is applied to a 90°-phase shifter V212 to get the quadrature component. In a parallel path (V210, V214) the inphase carrier signal is fed to multiplier N203.

For different TV systems NICAM B/G (5.85 MHz) or NICAM I (6.552 MHz) the 90°-phase shifter is switched over by control signal G. In NICAM I mode the signal G is set to logic high state, thus transistor V213 and diode V215 are switched off and capacitors C219/C221 are active. The phase can be adjusted by trimcap C221.
For TV system NICAM B/G the control signal G is low, transistor V213 and diode V215 are turned on, so capacitors C222 and C223 become active. The phase can be adjusted by trimcap C223.

For QPSK modulation the inphase- (0°) and quadrature signal (90°) of sound carrier 2 are applied to inputs CARR+ of the multiplier circuits, while I- and Q-data are fed to inputs SIG+. According to voltage difference of inputs SIG+ and SIG- a phase-shift keying of 0° and 180° of the carrier is realized. The modulated carrier products are summed at transformer T203 and are passed via buffer V217 to the RF Unit 10.
The amplitude of the I- and Q-signals must be equal and can be adjusted by trimpot R283 to the same value (see section 'Table of Checks and Adjustments).

4.11 RF UNIT (U10), Figures 149, 150



Block Diagram RF Unit

The RF Unit (U10) serves for generating a double-sideband modulated TV signal in the frequency range 32 MHz to 900 MHz. The unit consists of six oscillators, two amplifiers, modulator part, divider and lowpass filter which are built into different screened sections in the RF box. Supply voltages, control and modulation signals are applied from the motherboard U11.

Generation to the vision carrier frequency is achieved by six different oscillators VCO1A to VCO1F, five colpitts circuits up to 680 MHz and a Clapp oscillator for the upper frequency range 680 MHz to 900 MHz. These oscillators are turned on and tuned by the CITAC SAA3036 (Computer Interface for Tuning and Analog Control) via lines F1 to F6 and AFC from the motherboard. The CITAC is controlled by the microprocessor via the I²C-bus. The frequency ranges of the oscillators, tuning voltages and switching signals F1 to F6 are shown in the following table. The signals F1 to F6 are additionally used for switching the corresponding path of the lowpass filter.

Oscillator	Frequency Range (MHz)	Tuning voltage Range (Vdc)	Switching state CITAC output	IC318 (U11) Pin no.
VCO1A	32 to 89.75	≥3 to ≤27	H★	10
VCO1B	90 to 179.75	≥1.5 to ≤27	H	11
VCO1C	180 to 299.75	≥3 to ≤27	H	12
VCO1F	300 to 469.75	≥3 to ≤27	L	3
VCO1D	470 to 679.75	≥3 to ≤27	H	13
VCO1E	680 to 900.75	≥3 to ≤27	L	2

★ H = 12 V
L = 0 V

The oscillator voltage of VCO1B to VCO1F is coupled into a stripline by resistors 627 to 630 and R675 which are soldered to the inductance of the LC-circuit. By changing the position of the output coupling point the RF amplitude can be altered and serves for adjustment of the residual carrier, see section 'Table of Checks and Adjustments'; but adjustment should be done only if measured values exceed tolerances because of replaced components in the RF Unit, for example mixer or VCO1.

The RF signal is amplified by OM360 and fed into a 7 dBm double balanced mixer which is used as AM modulator. The video and sound signals are added at its modulating input 3/4. The video signal is dc-coupled (0.14 V to 1.54 V) while the sound signal is ac-coupled. From the output of mixer 354 the double-sideband modulated RF carrier is applied via the activated lowpass filter path and the RF attenuator (75 Ω) to the RF Output.

The lowpass filter operates in the lowest frequency range 32 MHz to 89.75 MHz as a tracking filter. The tuning voltage (AFC) is applied from the CITAC to varicaps 463 and 464 to tune the filter path. For frequencies >470 MHz the lowpass filter is by-passed via diodes 451 and 452. The filter needs no adjustment.

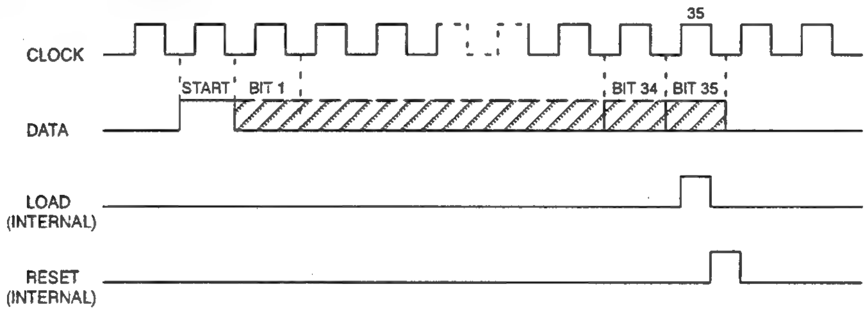
Additionally the generated RF carrier signal of VCO1A to VCO1F is used for the frequency control loop. The RF signal is applied from the stripline output to amplifier OM350, position 351. After dividing down by 256 the signal is fed via DIV OUTPUT to the CITAC (Unit 11). The CITAC compares this frequency with an internal generated reference (4 MHz clock) to supply the tuning voltage (AFC) for the VCO1 in order to lock the RF carrier frequency to the set value.

4.12 KEYBOARD AND DISPLAY UNIT (U12), Figures 151 to 153

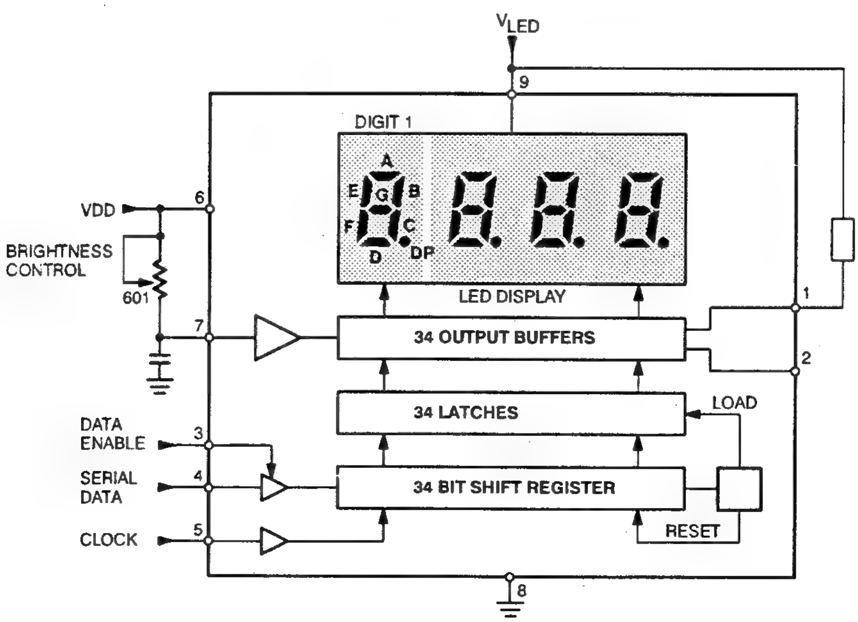
Depending on the instrument version two different Keyboard/display Units are mounted. Standard instruments have a keypad with 22 to 29 keys (Unit 12). Instruments with NICAM sound have an extended keyboard with a different PCB and 35 keys (Unit 12N).

Unit 12 contains a 4-digit LED display, pushbutton keys with the assigned LEDs next the keys (number of keys and LEDs depends on SOUND keypad) and its concerning decoder/driver circuits. Data transfer from the CPU is performed via the C-bus lines SCL, SDA and two control lines. Input data sensed from the keyboard matrix are sent as serial information from the control transmitter D301 via line KEYDAT to the CPU.

The display data including display and LED information are sent from the CPU via the C-bus to the display H451 and the LED display driver D302 by three signals: DATA (SDA), CLOCK (SCL), and Data Enable. Both display drivers have identical functions. The data format consists of a start bit followed by 34 data bits. During the data transfer from the CPU the enable lines $\overline{DISEN}$ and $\overline{LEDEN}$ are set and the data block is loaded to the shift register. These data are latched after the 35th bit is completed, thus providing non-multiplexed direct drive to the display/LEDs. A reset signal is generated internally which clears the shift register for the next data block.



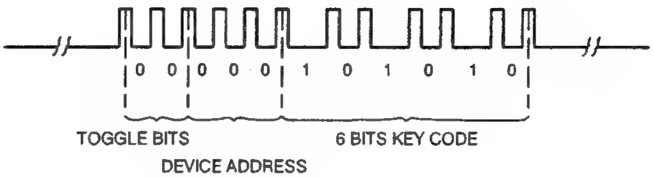
Input Data Format for Display and LEDs



Block Diagram Display H451

The brightness of the display is adjusted by potmeter R601 and for the LEDs by potmeter R602 in the Diagnostic Program, see 'Table of Checks and Adjustments'.

Input from the keyboard is achieved by means of the keyboard control transmitter D301, SAA3007, which controls the key matrix inputs and sends the keycode in serial data from the output pin 1 via line KEYDAT to the CPU. The input matrix consists of six driver outputs (D301 pin 13 to 18) and six sense inputs (pin 3 to 8). When a key is pressed the corresponding sense line is set to 'low' and D301 transmits a burst of 12 pulses including latched address and command codes. Data are available as long as a key is pressed.



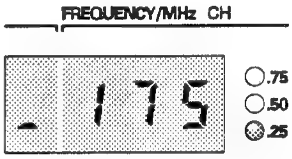
Data Format Signal 'KEYDAT'

For simple fault finding of the involved components of the keyboard and display please follow the 'Diagnostic Program', Section 7.2, sequence 2 to 5.

5 GENERAL FUNCTIONAL TEST

After POWER ON, the instrument is automatically set to the operating mode to which it was set before power off.

- Check for correct TV system:
  PM 5415, PAL/NTSC thumbwheel switch on the rear panel
  PM 5418, key PAL/NTSC/SECAM and the corresponding PAL/NTSC or SECAM thumbwheel switches on the rear panel.
- Under the SOUND area on the front panel, select the CARRIER and MODULATION INTERN by keys.
- Under the PATTERN area on the front panel, select the GREYSCALE/COLOR BAR/MULTIBURST patterns.
- Check the basic settings of the instrument:
  VIDEO AMPLITUDE 1 V
  CHROMA AMPLITUDE 100 %
- Set RF AMPLITUDE attenuator to 10 mV
- Select a vision carrier frequency that is suitable in the TV system, for example TV system G in VHF channel E5: 175.250 MHz (see table in the appendix).



- Connect the RF OUTPUT of PM 5415 / PM 5418 with the antenna input of a TV receiver.
- Check the correct video and sound reproduction on the TV receiver.
- Select and check additional test patterns.
- Connect an oscilloscope to the VIDEO OUTPUT (75 Ω termination).
- Select the patterns GREYSCALE/WHITE; set the VIDEO AMPLITUDE to stop position 1 V.
- Check that the video amplitude is 1 V (peak-peak), accuracy <5 %.

6 DISASSEMBLING THE INSTRUMENT

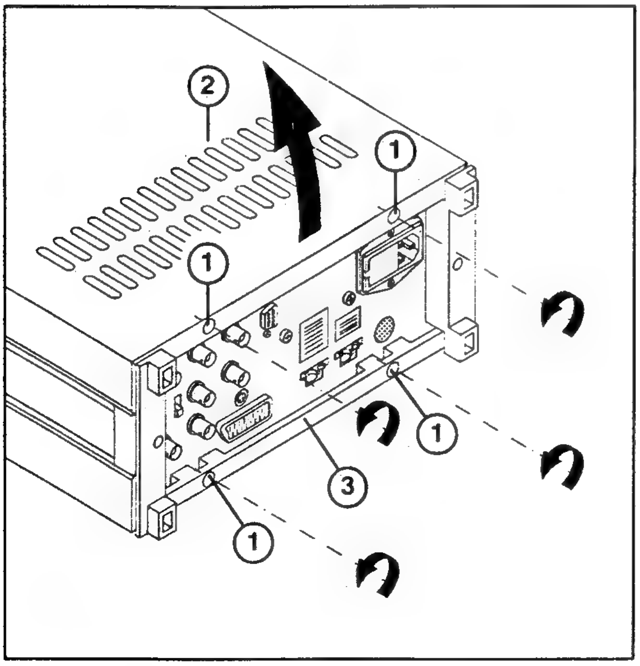
6.1 GENERAL INFORMATION

This section provides the disassembly procedures required for the removal of components during repair operations.
All circuit boards removed from the instrument must be adequately protected against damage, and all normal precautions regarding the use of tools must be observed.
During disassembly make a careful note of all disconnected leads so that they can be reconnected to their correct terminals when the instrument is reassembled.

6.2 REMOVING THE COVERS

WARNING

Removing the instrument covers or removing parts, except those to which access can be gained by hand, is likely to expose live parts, and accessible terminals may also be live.
To avoid electric shock, turn off line power and remove the power cord before disassembling the instrument.
If adjustment, maintenance, or repair of the disassembled instrument under voltage is necessary, it must be carried out only by qualified personnel using customary precautions against electric shock.
Capacitors inside the instrument may still be charged even after the instrument has been turned off or disconnected from the power supply.



- Loosen the four rear screws (**1**) of the covers (3 to 4 turns).
- Remove top cover (**2**).
- Remove bottom cover (**3**).

Figure 1, Top and Bottom Covers

6.3 UNITS 2 TO 8

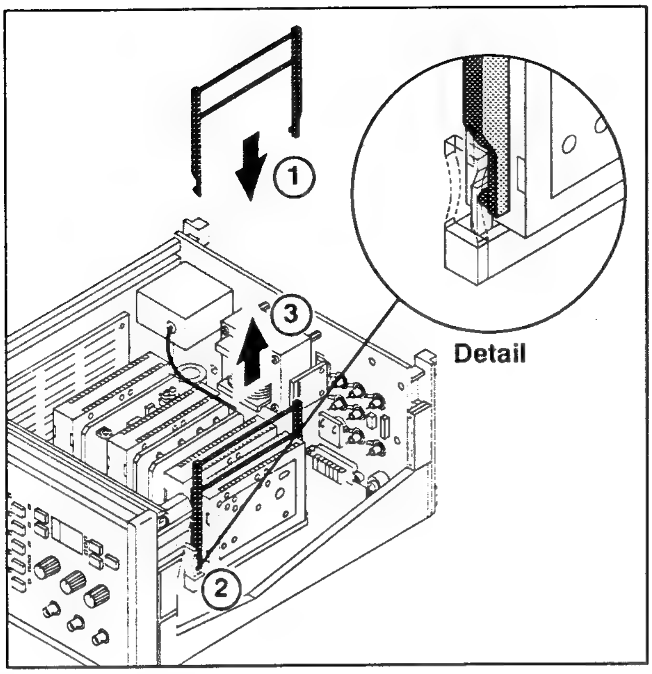


Figure 2, Removing plugged-in Units

- Remove top cover as shown in Figure 1.
- Insert the extraction tool (**1**) into the sockets of the unit (**2**).
- Take care that the hooks lock into the holes of the unit as shown in the detail.
- Remove the unit (**3**).

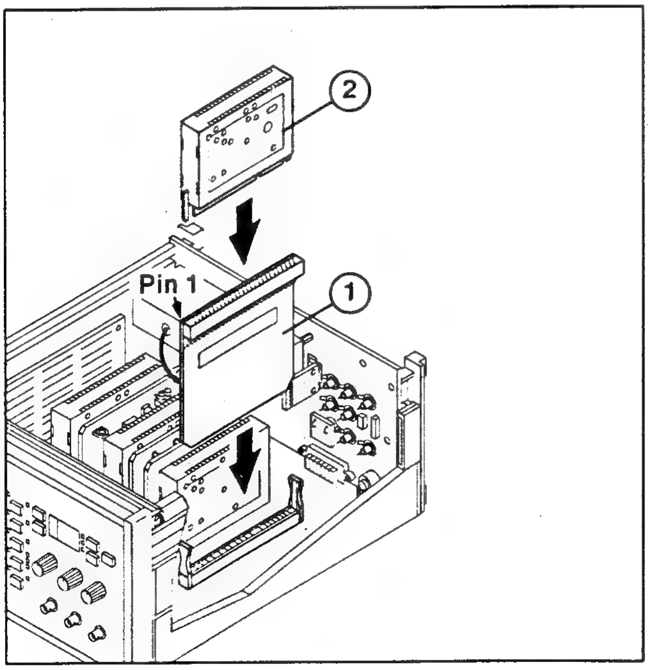


Figure 3, Extension Adapter

- For testing and adjusting a unit plug the Extension Adapter (**1**) into the socket.
- Plug the unit (**2**) into the adapter. Take note to correct plug-in direction.

6.4 UNIT 1, DIGITAL UNIT

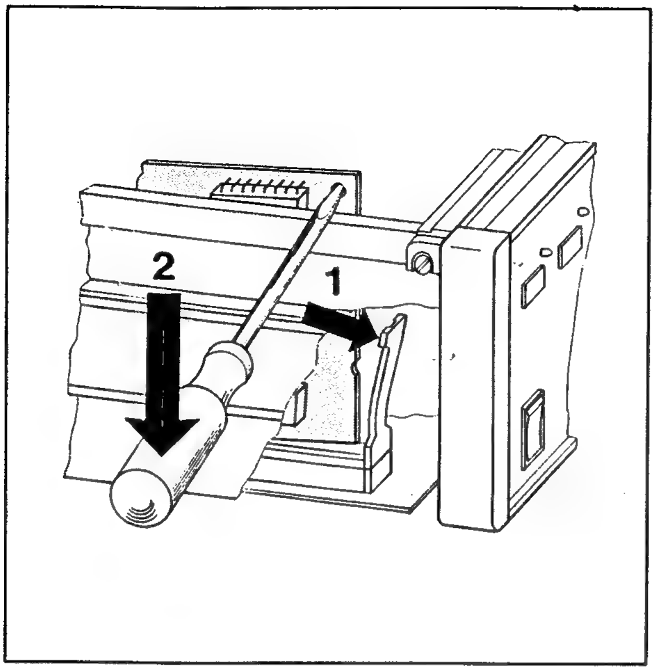


Figure 3, Extension Adapter

- Remove top cover as shown in Figure 1.
- Bend the locking clip (**1**).
- Insert a small screwdriver into the holes of the unit and remove the unit (**2**).

6.5 UNIT 10, RF UNIT

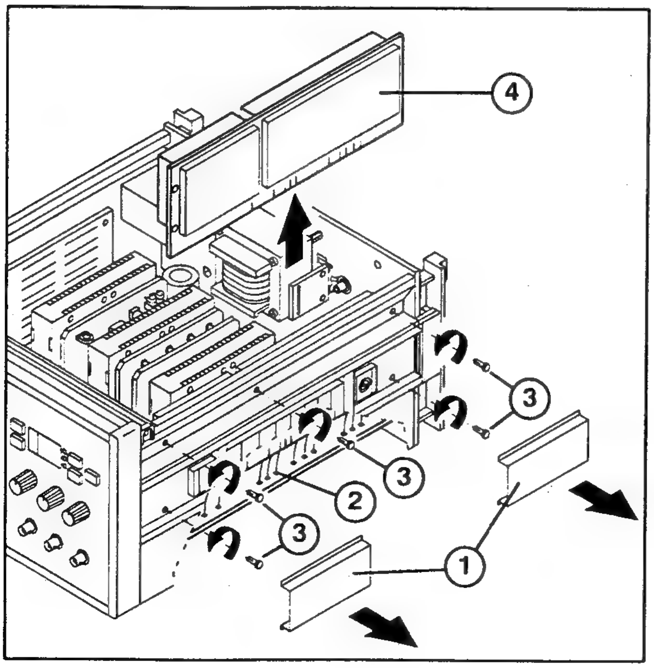


Figure 4, Removing the RF Unit

- Remove top cover as shown in Figure 1.
- Remove profile ornaments (**1**).
- Desolder the wiring to the main print (**2**).
  If necessary remove plugged-in unit next to the RF unit as shown in Figure 2.
- Unscrew the five screws (**3**).
- Remove RF unit (**4**) (remove plug from the attenuator to the RF unit).

6.6 FRONT PANEL EDGES AND SIDE PIECES

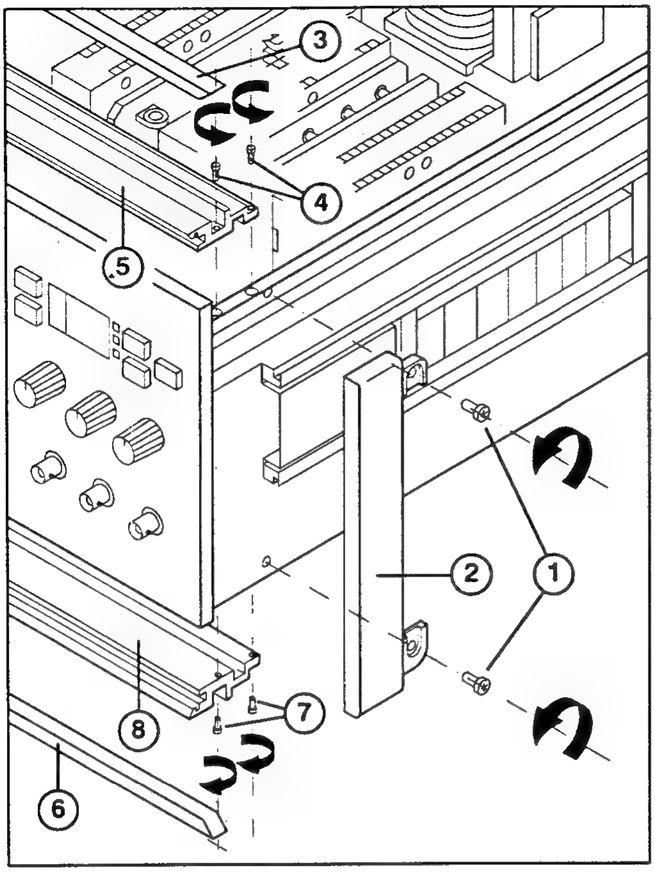


Figure 6, Removing the Edges and Side Pieces

The following steps are only necessary to get access to the text plate, the keyboard and to the attenuator/ potmeters.

- Remove covers as shown in Figure 1.
- Unscrew the two screws of the side piece (1).
- Remove side piece (2) (same procedure for the left hand side).
- Remove profile ornament (3).
- Unscrew the two screws of the upper front panel edge (4) (same procedure for the left hand side).
- Remove front panel edge (5).
- Remove profile ornament (6).
- Unscrew the two screws of the lower front panel edge (7) (same procedure for the left hand side).
- Remove front panel edge (8).

6.7 TEXT PLATE

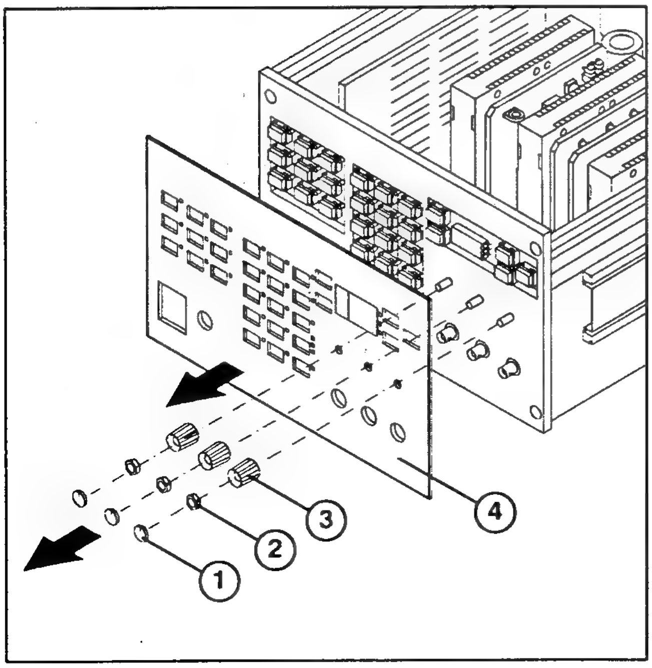


Figure 7, Removing the Text Plate

- Perform the steps shown in Figure 6.
- Remove caps of knobs (1).
- Loosen nuts of knobs (2).
- Remove knobs (3).
- Remove text plate (4) (it is fixed with stripes of adhesive tape).

6.8 UNIT 12, KEYBOARD

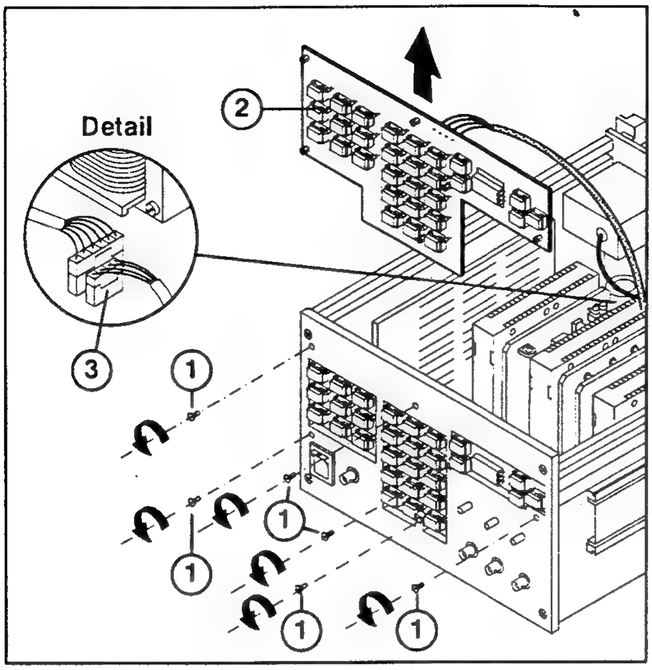


Figure 8, Removing the Keyboard

- Perform the steps shown in Figure 6 and Figure 7.
- Unscrew the five screws (1) of the keyboard.
- Remove the keyboard (2)
- Unplug the connector from the main print (3), shown in the detail.

6.9 RF ATTENUATOR, POTMETERS

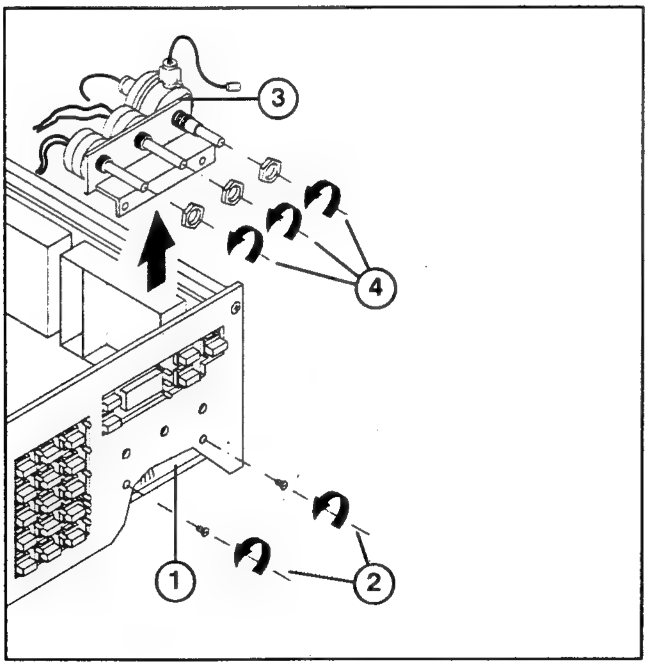


Figure 9, Removing the Attenuator / Potmeters

- Perform the steps shown in Figure 6 and Figure 7.
- Unplug the wire of the RF Unit.
- Desolder wiring from the main print or from the potmeters (1).
- Unscrew the two screws of the fixing angle (2).
- Remove attenuator and potmeters (3)
- Unscrew the nuts (4).

7 SELF-TEST PROGRAM, DIAGNOSTIC PROGRAM

7.1 SELF-TEST PROGRAM, ERROR MESSAGES

Immediately after power on and during further operation the internal program checks the main functions of the instrument. If a malfunction is detected an error message will be shown on the display (Err 1 to 5) and may be used for its localization. During some error messages a partial operating is possible (see table below).

Error Code	Localization of Malfunction	Remarks
Err 1	ROM, checksum error	
Err 2	RAM, write/read error	
Err 3	patterns	short indication
Err 4	vision carrier frequency	short indication; instrument retunes the previous frequency setting; otherwise followed by '–Er 4'
–Er 4	vision carrier frequency setting impossible	operating video is possible
Err 5	internal data bus	Bus error, units missing
Err 6	VPS EEPROM error	only incl. Digital Unit 1-VPS
Err 7	Nicam Units faulty	only instruments with Nicam sound

7.2 DIAGNOSTIC PROGRAM

The purpose of the diagnostic program is to help the Service Technician to locate an error bya simple procedure.

Moreover faults may be detected by other or conventional methods.

Generally the voltages of the power supply should be checked at first (see 'Table of Checks and Adjustments', Section 8.4).

The diagnostic program is activated by closing the solder bridge ST1 (TEST), located on the Motherboard U11 near PROM IC313.

After switching on the instrument all segments and decimal points of the display and all LEDs are switched on for about 3 seconds followed by indication 'tP–'.
The keys for sound and frequency keep their function except the DUAL sound key, only available in instruments with stereo sound. During the test mode it is possible to measure the single sound carriers.

MONO	sound carrier 1
DUAL	sound carrier 2
STEREO	sound carriers 1 and 2

Correct 'tP–' display (initial mode) allows the following test programs to be selected:

0. RAM test 1

Key in: 0; display: '0'

This test checks the RAM P8155, IC314 on the Motherboard.
The test duration depends on the instrument version (approximately 9 seconds). If no failure is detected the display returns to the initial indication 'tP–'; otherwise the display indicates 'FAIL'.

1. RAM test 2

Key in: 1; display:'1'

This test checks the CMOS-RAM PCD8583 (data memory), IC315 on the Motherboard. The test lasts about 2 seconds and depends on the instrument version. It is not allowed to turn off the instrument during this test.

2. Display test

Key in: 2; display: '8.8.8.8.'

All 7-segment digits and decimal points of the display are lightened. By pressing any key except the INPUT key they are switched off and on.
Pressing the INPUT key ends this test:
single segments including decimal points pass from the left to the right side of the display. Afterwards the initial display 'tP–' appears.

3. LED test

Key in: 3; display:'3'

All LEDs on the textplate are lightened. By pressing any key except INPUT the LEDs are switched off and on. Pressing the INPUT key ends the test.
The single LEDs are switched on and off in turn. Afterwards the test program returns to 'tP–'.

4. Keyboard test 1

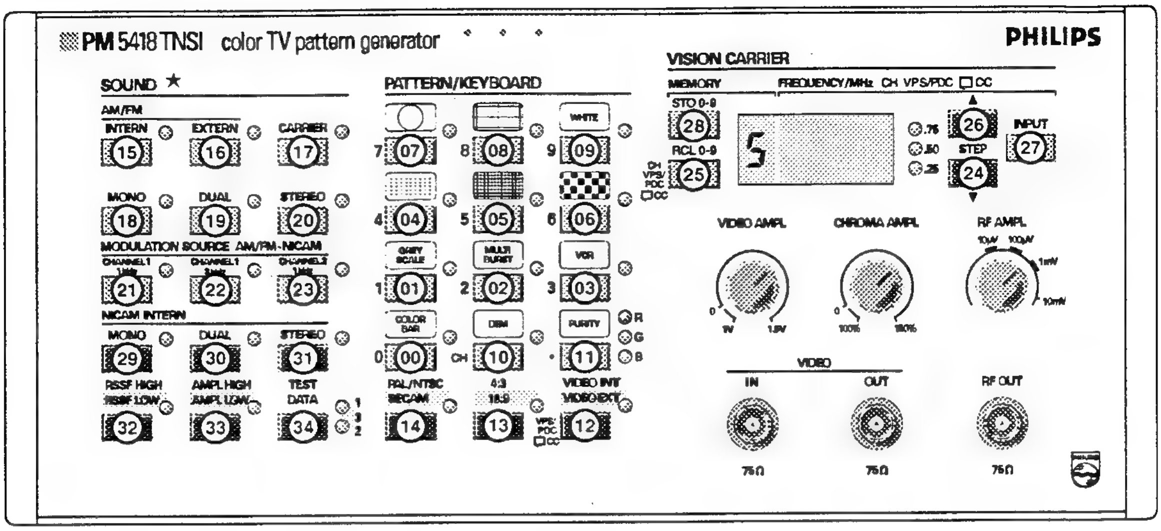
Key in: 4; display: '4'

Each key switched on the assigned LED next to the key. The test ends if a key is pushed 3 times.

5. Keyboard test 2

Key in: 5; display: '5'

The codes of pushed keys are decimally displayed; for code see below.
The test ends if a key is pushed 3 times. The test program returns to the initial display.



★ Keypad SOUND depends on instrument version

6. TV system test

By this test mode an indication of instrument version and selected TV system dependent on thumbwheel switch settings at the rear is possible. The numeric characters are available as continuous information on the serial data bus.
Meaning of the display values from left to right side:

Position	Details/Indication	Remarks
1	indication of test 6	always '6'
2	Videotext and Stereo modes: 1 Mono 3 Stereo	
3	SECAM thumbwheel switch indication always 0 indication 1 to 3	not available PM 5415 only PM 5418
4	PAL thumbwheel switch indication 0 to 7	depends on setting

7. Port test

Key in: 7; display: '7'

All ports B and C of P8155, IC314 on main print, are set to high level. Pressing any key except the INPUT key effects alternating low and high level at all ports. The INPUT key ends this test. This test may change settings of frequency, sound and patterns. For this reason the instrument should be switched off and on again for processor reset.

8. Program version

Key in: 8; display: 'C x.x.' (short indication)

The display shows for a short time the program version of the CPU, for example C 4.8 (IC313, CPU Motherboard).

9. Type of instrument

Key in: 9; display: type of instrument

After pressing the number 9 key the display shows for a short time the type of instrument; for example PM 5415: '5415'.

Open solder bridge ST1 to leave the diagnostic program.

8 CHECKING AND ADJUSTING

8.1 GENERAL INFORMATION

This chapter provides the complete adjustment procedure for the instrument. Because various control functions are interdependent, a certain order of adjustment is necessary. The procedure is, therefore, presented in a sequence best suited to particular adjustment.

- Warm-up time under average conditions is 30 minutes
- Adjustment should be done after 1 hour
- Ambient temperature (23 ±1) °C
- Line voltage, nominal value ± 10 %
- The screening cover of the units must be closed and should be removed only for a short time for adjustment.
- Instrument performance should be checked before any adjustment is done

- All limits and tolerances given in this section are calibration guides, and should not be interpreted as instrument specifications
- Tolerances given are for instrument under test and do not include test equipment errors

WARNING

High voltages exist at several points inside the instrument. To avoid injury, do not touch exposed connections and components while power is on. Disconnect line power before removing protective panels, soldering, or replacing components.

8.2 RECOMMENDED TEST EQUIPMENT

The following abbreviations are used for settings and for the test equipments:

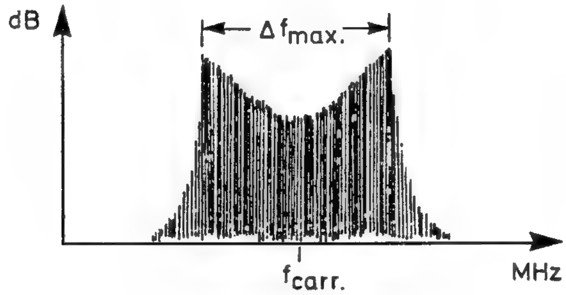
⊤	≙	Keep setting concerned
–	≙	Parameter not used
•—	≙	Output, terminated with 75 Ω, e.g. Suhner >1 GHz 0.5 W
Vdc, Vac	≙	Digital multimeter for ac and dc measurement, e.g. PM 2535
OSC	≙	Oscilloscope 50 MHz, e.g. PM 3055, line selector PM 8917
C/T	≙	Counter/Timer, e.g. PM 6665
SPA	≙	Spectrum analyzer 1 GHz, e.g. TEK 2710/01
FAM	≙	Modulation analyzer, e.g. R&S FAM/B2/B8 or FMAB
TV	≙	TV receiver: Multi-system TV inclusive stereo, Teletext, RGB/YC-input
Vector	≙	Vectorscope PAL/NTSC, e.g. PM 5667, Vectorscope SECAM, e.g. TTV8300 (C$F)
Notch Filter	≙	3 MHz-notch filter; Adjustment Table, Sequence 3.2; Figure 58, Circuit Diagram
VPS	≙	Videorecorder with VPS (Video Programming System), e.g. Philips
PDC	≙	Videorecorder with PDC (Programme Delivery Control), e.g. Philips
NICAM	≙	NICAM Decoder PAL G or PAL I, e.g. PM 5688

For repair procedure a **Service Kit** is available comprising two extension test boards and extraction tools (see Figure 59).
The kit can be ordered from PCS Eindhoven with service code number 5322 310 10579.

8.3 SOUND MODULATION (FM)

8.3.1 Measurements with Spectrum Analyzer

The sound carriers and modulation can be checked directly at the RF OUTPUT. Accuracy of FM measurements with a spectrum analyzer depends on type (for example frequency span, IF bandwidth 1 to 3 kHz). Indicated values for Δf_{max} are dependent on the modulation frequency and selected pre-emphasis of the pattern generator. Δf_{max} is the frequency spacing of both spectral lines with maximum amplitudes above and below the carrier frequency.



TV system	Pre-emphasis	SOUND INT 1 kHz	Specification	Spectrum Analyzer Value Δf_{max}
PAL B,G,H	50 µs	x	30 ±2 kHz	60
SECAM B,G,H	50 µs	x	30 ±2 kHz	60
PAL I	50 µs	x	27.5 ±2.5 kHz	55
PAL D	50 µs	x	24 ±4 kHz	46
SECAM D,K,K1	50 µs	x	24 ±4 kHz	46
PAL M,N	75 µs	x	15 ±5 kHz	30
NTSC M	75 µs	x	15 ±5 kHz	30
Stereo	50 µs	x	30 ±2 kHz	60
Stereo L	50 µs	x	15 ±1 kHz	30

8.3.2 Measurements with Modulation Analyzer (FAM or FMAB)

Accurate deviation can be measured at the Sound Carrier Output (Unit 8, pin 5) of the Mono Sound Unit (U8), respectively the RF Stereo Unit (U8/ST) or TWIN RF UNIT (U8/TWIN).

Instrument settings FAM (FMAB):

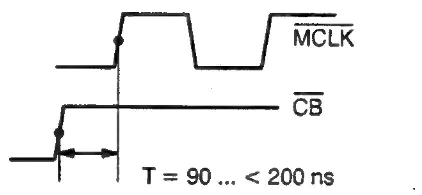
De-emphasis:	50 µs for PAL/SECAM B,D,G,H,I,K,K1
	75 µs for PAL M, N and NTSC M
Filter:	10 Hz to 20 kHz

The second sound carrier can be measured in the stereo sound instruments by selecting the **Diagnostic Program** (see Section 7.2):

DUAL — press the DUAL key

8.4 TABLE OF CHECKS AND ADJUSTMENTS

Seq.	SETTINGS									MEASURING					
	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
1.1	PAL G							TP1, Unit 11 (U11) (S123, pin 46)	Vdc	5 V ± 10 mV		R612, U11	x		**Power supply;** hum <2 mV-pp
1.2								TP2, U11 (S123, pin 45)	Vdc	12 V ± 20 mV		R606, U11	x		hum <3 mV-pp
1.3								TP3, U11 (S123, pin 44)	Vdc	−12 V ± 20 mV		R611, U11	x		hum <4 mV-pp
1.4								TP4, U11 (Cath. D404)	Vdc	58 V ± 4 V				x	hum <4 V-pp
1.5								TP5, U11 (R608)	Vdc	6.1 V ± 0.25 mV				x	CMOS supply voltage
1.6								Scart Output pin 8	Vdc	9.5 V to 12 V 4.5 V to 7 V				x x	Function switching at Scart Output Aspect ratio 4:3 Aspect ratio 16:9
1.7								TP6, U11 +Pole, Battery G885	Vdc	≥2.9 V				x	Supply voltage for RAM D315 (U11)
1.8								TP7, U11 RAM D315, pin 8	Vdc	>2.5 V				x	RAM supply 'UBACK', switch Power OFF
1.9			DIAGNOSTIC PROGRAM					via R603/U12	Vdc	600 mV ± 30 mV		R601/U12		x	**Display/keyboard Unit 12 (Unit 12N)** Only necessary after component replacement on Unit. Close solder joint 'TEST' on mainprint (see Section 7.2 Diagnostic Program). Select No.2 Display Test. Display, all segments ON (U12)
1.9.1			DIAGNOSTIC PROGRAM					via LED H408/U12N	Vdc	6 mA ± 0.3 mA		R601/U12N		x	Connect current meter via H408, Unit 12N
1.10			DIAGNOSTIC PROGRAM					via LED H406, U12 or U12N	Vdc	6 mA ± 0.3 mA		R602/U12 R602/U12N		x	LEDs, all LEDs ON (select No.3 LED Test), connect current meter via LED H406
1.11			DIAGNOSTIC PROGRAM											x	Keyboard test, select and follow Keyboard Test 1 and 2 leave the Test, open solder joint 'TEST'

Seq.	SETTINGS									MEASURING					
	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
2.1	PAL G							TP8, U11 (IC324 Pin 11)	C/T	5.000 MHz ±5 Hz		C542, U11	x		**Master OSC,** TV standard PAL, standard versions (use high imped. probe 10:1); Only instruments with NICAM or IEEE-bus
2.1.1	PAL G								C/T	5.000 MHz ±1 Hz		C542, U11	x		
2.2	NTSC M							TP8, U11 (IC324 Pin 11)	C/T	5.034964 MHz ±5 Hz		C542, U11	x		**Master OSC,** TV standard NTSC, standard versions (use high imped. probe 10:1). Only instruments with NICAM or IEEE-bus
2.2.2	NTSC M								C/T	5.034964 MHz ±1 Hz		C542, U11	x		
2.3	PAL G							TP9A, U11 TP9B, U11	OSC, input A OSC, input B					x	**Setting phase of main clock MCLK** (Unit 1) Only necessary after replacement of Sync. Generator N324/U11 or complete Unit 1. T = 90 ns to < 200 ns If T of phase MCLK to CB is less 90 ns set jumper X801/U1 or X801/U1-VPS to INV respectively NINV position.
2.4	PAL G	WHITE GREY SCALE						SYNC OUT	OSC	5 V ± 0.2 V-pp	1			x	Field sync pulse
2.5	PAL G							SYNC OUT		2.6 V ± 0.3 V-pp	1			x	Line sync pulse
2.6	PAL G		CARR.OFF		1 V	0 %		TP10 (Anode V443)		0 V ±40 mV		R664,U11	x		Blanking level, DC value
2.7	PAL G	VIDEO EXT			1 V	0 %		TP10		0 V ±50 mV				x	Apply ext. BW video signal 1 V-pp to VIDEO IN
2.8	PAL G	VIDEO EXT			1 V	0 %		TP10		3 V ±0.1 V-pp				x	Video amplitude
2.9	PAL G	WHITE GREY SCALE						VIDEO OUT •—		0 V ± 140 mV				x	Blanking level, DC value
2.10	PAL G							VIDEO OUT •—		1 V ±40 mV-pp				x	Video amplitude PAL, into 75 Ω load
2.11	NTSC M							VIDEO OUT •—		1 V ±40 mV-pp				x	NTSC M, into 75 Ω load
2.12	NTSC M							VIDEO OUT •—		0.28 V ±10 mV-pp				x	Sync amplitude, NTSC M, into 75 Ω load
2.13	PAL G							VIDEO OUT •—		0.3 V ±10 mV-pp				x	PAL G, into 75 Ω load
2.14	NTSC M							VIDEO OUT •—		*54 mV ±5 mV				x	Black level lift (setup), NTSC M, PAL M * value > blanking level
2.15	PAL G							VIDEO OUT •—		Blanking level				x	Black level without lift for PAL G
2.16	PAL G							TP11 (X40), U11		1.4 V ±40 mV		R696, U11	x		Video signal applied to RF Unit U10

	SETTINGS									MEASURING					
Seq.	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
3.1	PAL G	MULTI BURST, GREY SCALE	CARR.OFF		1 V	0 %		VIDEO OUT •—	OSC ext. Trigger	Line sync pulses		R786, U6	x		**Multiburst Unit (U6),** DC level adjust pairing of line sync pulses
3.2								VIDEO OUT	OSC 3 MHz-notch filter *	3 MHz ± 15 kHz		R757, U6	x		Frequency Multiburst, adjust burst frequency 2.8 MHz/3.2 MHz to same amplitude; * Example of circuit diagram see Fig. 58
3.3								VIDEO OUT •—	OSC ext. Trigger	Ampl. Multiburst		R676, U11	x		Amplitude of Multiburst, adjust to max. value of black and white level
3.4								VIDEO OUT •—		<2 x 10 mV-pp				x	Amplitude response of Multiburst
4.1	PAL G	DEM	CARR.OFF		1 V	100 %		TP12, U11 (S126, pin 34	OSC	2 V ± 50 mV-pp		R662, U2	x		Amplitude **subcarrier (Unit 2)**
4.2	PAL G							TP12, U11 (SUBCARR.OUT)	COUNTER/TIMER	4.433619 MHz ± 44 Hz*				x	Subcarrier frequency; PAL G (locked to the master clock)
4.3	NTSC M									3.579545 MHz ± 36 Hz*				x	NTSC M
4.4	PAL M									3.575611 MHz ± 36 Hz*				x	PAL M
4.5.	PAL N									3.582056 MHz ± 36 Hz*				x	PAL N
										*fc ± 7 Hz				x	* only instruments with NICAM or IEEE-bus
4.6	PAL G	GREY SCALE, COLOR BAR, MULTI BURST, DEM	CARR.OFF		1 V	100 %		VIDEO OUT •—	Vector PAL	90° ± 1°	4	C509, U2	x		Phase of PAL burst Ev to Eu (Unit 2)
4.7	PAL G								Vector PAL, OSC	within 3° (5 %)	2, 4	R633, U2	x		Relative amplitude Ev to Eu (Unit 2) set vectorscope ampl. R-Y component to correct tolerance field (Red), adjust B-Y component by R633 (blue, yellow)
4.8	PAL G								Vector PAL	see Figure	4			x	Vectors V, U (PAL), Unit 2
4.9	NTSC M								Vector NTSC	see Figure	3, 4			x	Vectors V, U, I, Q (NTSC), Unit 2
4.10	PAL G	GREY SCALE, COLOR BAR, MULTI BURST, VCR							~~Vector~~ PAL	see Figure	7			x	Saturation steps, Unit 2
5.1	PAL G	PURITY RED	CARR.OFF		1 V	150 %		VIDEO OUT •—	OSC ext. Trigger	use chroma amplitude for reference A				x	Chroma setting 150 %, 100 %
5.2	PAL G				1 V	100 %				adjust to 2/3 x A		R156, U11	x		use reference value Seq. 5.1
5.3	PAL G				1 V	0 %				Chroma <2 mV-pp				x	Chroma amplitude '0'
5.4	PAL G	WHITE, GREY SCALE			1.5 V	0 %				Video 1.5 ± 0.1 V-pp				x	max. video amplitude
5.5	PAL G				0 V	0 %				Video <10 mV-pp				x	min. video amplitude
5.6	PAL G	COLOR BAR	CARR.OFF		1 V*	100 %		VIDEO OUT •—	Vector, PAL, OSC	within 3° (5 %)	8	R153, U11	x		Relation chroma/luminance * set potm. Video Ampl to 1 V-pp at VIDEO OUT
5.7	NTSC M				1 V*	100 %			Vector, NTSC	within 3° (5 %)				x	NTSC M; iterate with Seq. 5.6
5.8	PAL G	*			1 V	100 %			OSC	<20 mV-pp				x	Residual subcarrier for PAL * black pattern ≙ all patterns OFF
5.9	NTSC M				1 V	100 %			OSC	<20 mV-pp				x	NTSC M

Seq.	SETTINGS									MEASURING					
	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
6.1	PAL G	WHITE	CARR.OFF	182.25	1 V*	100 %	max.	RF OUTPUT VIDEO OUT	TV OSC	Luminance, blanking for circle				x	**Black/white patterns** * set VIDEO AMPL to 1 V-pp at VIDEO OUTPUT
6.2	PAL G									Pulse 200 ns ±10 ns see Figure	10,12 13			x x	Check center indication, 2T-filter Pattern without interlacing
6.3	NTSC M									see Figure	11,12			x	PAL M, NTSC M
6.4	PAL G									see Figure	14			x	Checkerboard (check additional NTSC)
6.5	PAL G	GREY SCALE								see Figure	15			x	Greyscale (check additional NTSC)
6.6	PAL G	MULTI BURST								see Figure	16			x	Multiburst (check additional NTSC)
6.7	PAL G,I	GREY SCALE, COLOR BAR, MULTI BURST, VCR	CARR.OFF	182.25	1 V*	100 %	max.	RF OUTPUT VIDEO OUT	TV, OSC Vector, PAL	see Figure	5, 7			x	**Color patterns** * set VIDEO AMPL to 1 V-pp at VIDEO OUTPUT
6.8	NTSC M								Vector, NTSC	see Figure	6, 7			x	Color generating (U2) and analog luminance signals, moving pattern
6.9	PAL G,I	GREY SCALE, COLOR BAR, MULTI BURST, DEM							TV, OSC Vector, PAL	see Figure	2, 4			x	Color generating (U2), analog signals
6.10	NTSC M								Vector, NTSC	see Figure	3, 4			x	NTSC M
6.11	PAL G,I	DEM							TV, OSC Vector, PAL	see Figure	17,19			x	Chroma (G-Y) = 0 (left part 1st horizontal bar shows skin color on TV screen)
6.12	NTSC M								Vector, NTSC	see Figure	18,19			x	
7.1	PAL G	VIDEO EXT.	CARR.OFF	RECALL 0*			max.	RF OUTPUT	Counter/Timer	32.0 MHz ±15 kHz				x	**Vision carrier frequencies; RF Oscill:** * store freq. settings to memory by: STORE CH △ STEP — VCO 1a
7.2				RECALL 1						89.9 MHz ±15 kHz				x	VCO 1a
7.3				RECALL 2						90.0 MHz ±20 kHz				x	VCO 1b
7.4				RECALL 3						179.9 MHz ±15 kHz				x	VCO 1b
7.5				RECALL 4						180.0 MHz ±15 kHz				x	VCO 1c
7.6				RECALL 5						299.75 MHz ±15 kHz				x	VCO 1c
7.7				RECALL 6						470.0 MHz ±25 kHz				x	VCO 1d
7.8				RECALL 7						679.75 MHz ±30 kHz				x	VCO 1d
7.9				RECALL 8						680.0 MHz ±30 kHz				x	VCO 1e
7.10				RECALL 9						900.75 MHz ±35 kHz				x	VCO 1e
7.11				RECALL 5 +0.25 MHz						300.0 MHz ±20 kHz				x	VCO 1f
7.12				RECALL 6 −0.25 MHz						469.75 MHz ±25 kHz				x	VCO 1f
7.13	PAL G	VIDEO EXT.	CARR.OFF	32 to 300	1 V	100 %	max.	RF OUTPUT •—	SPA	≤ −35 dBc				x	Harmonics vision carrier (1st/2nd)
7.14	PAL G	WHITE, GREY SCALE	CARR.OFF	182.25	1 V	100 %	max.	RF OUTPUT •—	SPA	−20 dB ±0.5 dB (10 % ±1%)		R717, U11	x		**Residual carrier** (AM neg), except NICAM versions RF amplitude >80 dBμV, (10 mV at 75 Ω); check for equidistant steps of Greyscale pattern in linear demodulated video signal or IF signal
7.15	PAL G			650/900					SPA	−20 dB ±6 dB				x	
7.16	PAL G			182.25	1 V	100 %	max.	RF OUTPUT •—	SPA	−14 dB ±0.5 dB		R717, U11	x		Residual carrier (AM neg), only NICAM versions
7.17	PAL G	VIDEO EXT.	CARR.OFF	182.25	1 V	100 %	10 mV	RF OUTPUT •—	SPA, TV	80 dBμV (10 mV)		R753, panel		x	Mechanical adjustment of attenuator RF AMPL (R753) to panel indication '10 mV'

Seq.	SETTINGS											MEASURING						
	TV SYSTEM	PATTERN	SOUND				FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
			CARR	MODE	INT	EXT												
																		MONO SOUND UNIT (U8)
8.1	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT	SPA, TV	13 dB		R644, U8	x		Ratio vision to sound carrier, PAL G
8.2	PAL D												11 dB ±1 dB				x	PAL D
8.3	PAL I							–	–				12 dB ±1 dB				x	PAL I
8.4	NTSC M												13 dB ±1 dB				x	NTSC, PAL M, PAL N
8.5	PAL G	PURITY RED	ON	MONO	OFF	OFF	470	1 V	100 %	max.	RF OUTPUT	SPA, TV	≤ −55 dBc				x	Intermodulation products
8.6	PAL G						680/800	1 V	100 %				≤ −50 dBc				x	(vision carrier to fvc ±1.1 MHz
8.7	PAL G						900	1 V	100 %				≤ −46 dBc				x	on screen no visible interference!
8.8	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	–	–	–	–	Unit 8, pin 5 (S130, pin 5)	C/T	5.5 MHz ±55 Hz				x	Sound carrier frequencies, PAL G Sound carrier is locked to master clock.
8.9	PAL D												6.5 MHz ±65 Hz				x	PAL D
8.10	PAL I						–	–	–	–			6.0 MHz ±60 Hz				x	PAL I
8.11	NTSC M												4.5 MHz ±45 Hz				x	NTSC M, PAL M, PAL N
8.12	PAL G	VIDEO EXT.	ON	MONO	ON 1 kHz	OFF	182.25	1 V	100 %	max.	RF OUTPUT (Unit 8, pin 5)	SPA, TV (FAM)	30 kHz ±0.5 kHz		R629, U8	x		Sound modulation FM, deviation, for measurement hints see Section 8.3
8.13	PAL D												24 kHz ±4 kHz				x	PAL D
8.14	PAL I												27.5 kHz ±2.5kHz				x	PAL I
8.15	NTSC M												15 kHz ±5kHz				x	NTSC M, PAL M, PAL N,
8.16	PAL G										Scart C., pin 3	C/T Vac	1 kHz ±100 Hz 400 ±20 mV-rms				x	Internal audio signal, 1 kHz Amplitude int. audio signal
8.17	PAL G	VIDEO EXT.	ON	MONO	OFF	ON	182.25	1 V	100 %	max.	RF OUTPUT (Unit 8, pin 5)	SPA, TV (FAM)	30 kHz ±2 kHz				x	External sound modulation, FM deviation; apply ext. audio signal to AUDIO IN, pin 3: sine wave, 500 Hz, 400 ±20 mV-rms
																		ANALOG STEREO SOUND UNITS (U7/ST, U8/ST), for a rough check or function test use TV with Stereo/Dual sound decoder.
9.1	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT	SPA	13 dB		R614, U8/ST	x		Ratio vision to sound carrier 1
9.2	PAL D...M	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT	SPA	see Seq. 8.2/8.4				x	PAL D to PAL M, NTSC; use Seq. 8.2 to 8.4
9.3	PAL G	VIDEO EXT.	ON	STEREO	OFF	OFF	182.25	–	–	max.	RF OUTPUT	SPA	20 dB		R638, U8/ST	x		Ratio vision to sound carrier 2
9.4	PAL D...M			STEREO							RF OUTPUT	SPA	–				x	Sound carrier 2, not present
9.5	PAL G			MONO				–	–		Unit 8/ST, pin 5 (S130, pin 5)	C/T	5.5 MHz ±55 Hz				x	Frequency sound carrier 1 (standard instr.), sound carrier OSC is locked to the master clock
9.6	PAL D...M											C/T	see Seq. 8.9/8.11				x	PAL D to PAL M, NTSC; use Seq. 8.9 to 8.11
9.7	PAL G											C/T	5.5 MHz ±11 Hz				x	Frequency sound carrier 1 (IEEE-bus instr.)
9.8	PAL G	VIDEO EXT.	ON	DUAL*	OFF	OFF	182.25	–	–		Unit 8/ST, pin 5 (S130, pin 5)	C/T	5.742188 MHz ±57 Hz				x	Frequency sound carrier 2 (standard instr.), * select Diagnostic Progr., close solder joint 'TEST' (on Unit 11).
9.9	PAL G											C/T	5.742188MHz ±12Hz				x	Frequency sound carrier 2 (IEEE-bus instr.)
9.10	PAL G	VIDEO EXT.	ON	MONO	1 kHz L						RF OUTPUT (Unit 8/ST, pin 5	SPA, TV FAM	±30 kHz ±0.5 kHz		R602, U8/ST	x		Sound modulation carrier 1 (FM), for hints see Section 8.3.
9.11	PAL D...M												see Seq 8.13/8.15				x	PAL D to PAL M, NTSC; use Seq. 8.13 to 8.15

	SETTINGS											MEASURING						
Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	SOUND EXT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
9.12 9.13	PAL G	VIDEO EXT.	ON	DUAL STEREO	1 kHz L/R 1 kHz R	OFF	182.25			max.	RF OUTPUT (Unit 8/ST, pin 5)	SPA, TV (FAM)	±30 kHz ±0.5 kHz ±30 kHz ±0.5 kHz *		R654, U8/ST	 x	x	FM, deviation DUAL sound, carrier 1 and 2 FM, deviation carrier 2 * final adjustment to minimum stereo cross-talk (L to R channel)
9.14 9.15				STEREO STEREO	1 kHz L OFF						RF OUTPUT		±15 kHz ±1 kHz ±2.5 kHz ±500 Hz				x x	Deviation carrier 1, channel R = OFF Deviation carrier 2 caused by pilot carrier
9.16 9.17	PAL G	VIDEO EXT	ON	MONO MONO	1 kHz L 3 kHz L	OFF OFF	182.25			max.	Scart, pin 3 Scart, pin 3	C/T, Vac C/T, Vac	1 kHz ±100 Hz 3 kHz ±300 Hz				x x	Sound intern 1 kHz and 3 kHz, amplitude 400 mV ±20 mV-rms
9.18				STEREO	OFF	ON					RF OUTPUT	SPA (FAM), TV	±30 kHz ±2 kHz				x	Sound extern, FM deviation, apply ext. audio signal to AUDIO IN, pin 3: sine wave, 500 Hz, 400 ±20 mV-rms; apply to pin 5: sine wave, 2 kHz, 400 ±20 mV-rms
9.19 9.20	PAL G	VIDEO EXT.	ON	MONO MONO	OFF	OFF					Unit 7/ST, pin 20 Unit 7/ST, pin 20	Counter/Timer Vac	54687.5 Hz ±0.5 Hz 31 mV ±3 mV-rms				x x	Pilot frequency, Amplitude of pilot signal
9.21 9.22				DUAL DUAL							U7/ST, IC315 pin 1 Unit 7/ST, pin 20	Counter/Timer OSC	274.1 Hz m = 50 % ±5 %				x x	Indentification frequency, DUAL sound AM pilot carrier, DUAL sound
9.23 9.24				STEREO STEREO							Unit 7/ST, pin 20 U7/ST, IC315 pin 7	OSC Counter/Timer	m = 50 % ±5 % 117.5 Hz				x x	AM pilot carrier, STEREO sound Identification frequency, STEREO sound
																		TWIN LF/TWIN RF SOUND UNITS (U7/TWIN, U8/TWIN), NICAM SOUND
10.1 10.2	PAL G PAL D	VIDEO EXT.	ON	MONO	OFF	OFF					Unit 8/TWIN, pin 5 (S130, pin 5)	Counter/Timer	5.5 MHz ±11 Hz 6.5 MHz ±13 Hz				x x	Sound carrier frequency (PAL G), the sound carrier OSC is locked to master clock PAL D
10.3 10.4	PAL I NTSC M												6.0 MHz ±12 Hz 4.5 MHz ±9 Hz				x x	PAL I NTSC M, PAL M, PAL N
10.5 10.6	PAL G PAL I	VIDEO EXT.	OFF OFF	NICAM NICAM	DATA 3 DATA 3						Unit 8/TWIN, pin 5 (S130, pin 5)	Counter/Timer	5.850 MHz ±12 Hz 6.552 MHz ±13 Hz				x x	Set instrument to the TEST mode: close solder joint 'TEST' on motherboard U11. NICAM carrier frequency, PAL G NICAM carrier frequency, PAL I
10.7	PAL G		ON	NICAM OFF	DUAL								5.7421875 MHz ±12 Hz				x	Sound carrier 2 frequency, analog STEREO leave the TEST, open solder joint 'TEST'
10.8 10.9 10.10	PAL G PAL I PAL D...M	VIDEO EXT.	ON	SOUND OFF NICAM OFF		OFF	182.25			max.	RF OUTPUT	SPA	13 dB 12 dB ± 1 dB	A* A*	R121, U8/TWIN	x	 x	Ratio vision to sound carrier 1, PAL G Ratio vision to sound carrier 1, PAL I PAL D to PAL M, NTSC use Seq. 8.13 to 8.15
10.11 10.12	PAL G PAL G, I		ON OFF	STEREO NICAM	OFF DATA 3	OFF OFF							7 dB 7 dB ±2 dB	A* A*	R219, U8/TWIN	x	 x	Ratio sound carrier 2 to sound carrier 1 Ratio NICAM carrier 1 to sound carrier 1
10.13 10.14 10.15	PAL G PAL G SECAM L	WHITE GREY SCALE	OFF	OFF	OFF	OFF	182.25 650/900 182.25	1 V	100 %	max.	RF OUTPUT	SPA SPA SPA	−14 dB ±0.5 dB −14 dB ±6 dB −20 dB ±0.5 dB		R717, Unit 11 R710, Unit 11	x x	 x 	Residual carrier, set RF amplitude to <80 dBµV (10 mV at 75 Ω). Check equidistant steps of Greyscale in the linear demodulated video- or IF-signal. Residual carrier (AM pos.), only PM 5418 NICAM

A* = Figure A see next page

Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	SOUND EXT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
																		U7/TWIN, U8/TWIN, NICAM SOUND CONTINUED
10.16	PAL G	VIDEO EXT.	ON	MONO CH1, 1 kHz, NICAM OFF			182.25			max.	RF OUTPUT (U8/TWIN, pin 5)	SPA, TV (FAM)	±30 kHz ±0.5 kHz		R103, U8/TWIN	x		FM, deviation sound carrier 1 FAM setting: de-emphasis 50 µs, filter 25 Hz to 50 kHz
10.17	PAL G	↓	ON	STEREO CH2, 1 kHz, NICAM OFF			182.25			↓	RF OUTPUT	AMF 2 (SPA)	±30 kHz *		R201, U8/TWIN	x		FM, deviation sound carrier 2 * adjust to minimum stereo crosstalk (L to R channel), use Stereo Demodulator, e.g R&S AMF 2
10.18	SECAM L	VIDEO EXT.	ON	MONO CH1, 1 kHz			182.25			max.	U8/TWIN, pin 5	OSC,TV	50 % ±5 %				x	AM sound modulation, only PM 5418 NICAM
10.19																		**NICAM, 4-QSPK signal** The modulated NICAM carrier is adjusted by NICAM sound demodulator, e.g. PM 5688. Connect I- and Q-output of PM 5688 to oscilloscope; OSC settings: X/Y-mode, select equal input sensitivity of channel A/B
10.20	PAL I	VIDEO EXT.	ON	NICAM	MONO		38.9			max.	RF OUTPUT	PM 5688/I and OSC	Phase I/Q-signal	B	C221, U8/TWIN	x		4-QSPK signal (PAL I), adjust I/Q-signals right-angled, see Figure B.
10.21	PAL I	↓	↓	↓	↓		↓			↓	↓		Ampl. I/Q-signal	B	R283, U8/TWIN	x		adjust I/Q-signals to same amplitude
10.22	PAL G	↓	↓	↓	↓		↓			↓	↓	PM 5688/G and OSC	Phase I/Q-signal	C	C223, U8,TWIN	x		4-QSPK signal (PAL G), adjust I/Q-signals right-angled, see Figure C.
10.23	PAL G	↓	↓	↓	↓		↓			↓	↓		Ampl. I/Q-signal	C			x	I/Q-signals must have the same amplitude
10.24	PAL G	VIDEO EXT.	OFF	NICAM	TEST/ DATA 2		38.9			max.	RF OUTPUT	SPA	minimum		R253, U8/TWIN	x		NICAM residual carrier suppression, set instrument to TEST-mode, see Seq. 10.5,
							↓			↓		SPA	≤ −40 dB	D	R273, U8/TWIN	x		reference: sidebands fvc +(5.85 MHz ± 182 kHz)
10.25	PAL G		ON	NICAM STEREO	CH1, 3 kHz CH2, 1 kHz						NICAM CLOCK	C/T, Vac	728 kHz ±2 ppm 1V-pp ±0.2 V-pp				x	NICAM CLOCK, output signal
10.26	PAL G			NICAM	DATA 1						NICAM DATA	C/T, Vac	91 kHz 1 V-pp ±0.2 V-pp				x	DATA OUTPUT signal
10.27	PAL G		ON	NICAM STEREO + analog STEREO	CH1, 3 kHz CH2, 1 kHz		182.25 (38.9)	1 V	100 %	max.	RF OUTPUT	TV (PM5688)					x	STEREO, NICAM, functional check of sound. TV shows, e.g. NICAM sound
10.28	↓	↓	↓		RSSF LOW		↓	↓	↓	↓	↓	↓					x	TV shows, e.g. NICAM available, sound is switched over, see table in the Operating Manual PM 5415/18, Section 10.2.2

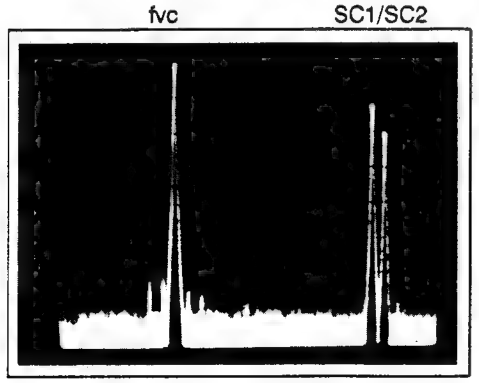


Figure A Ratio Vision to Sound Carrier 1 and 2 (unmodulated)

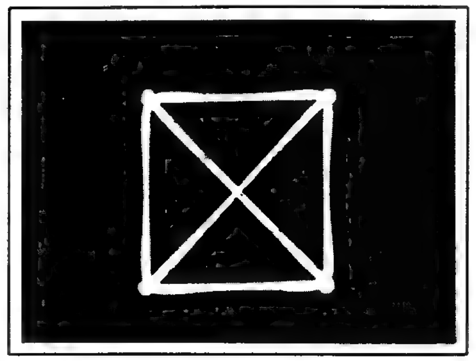


Figure B I/Q−signal PAL I

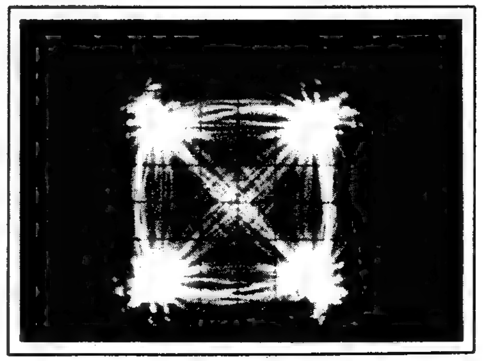


Figure C I/Q−signal PAL G

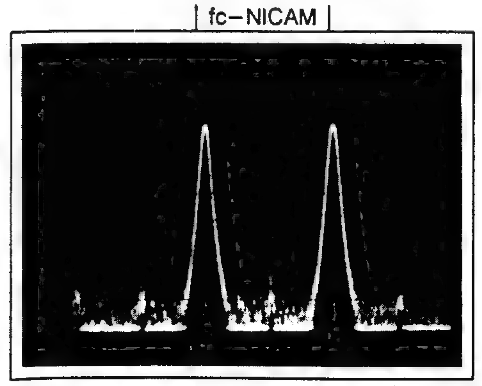


Figure D NICAM Sound Carrier Suppression (TEST DATA 2)

	SETTINGS									MEASURING					
Seq.	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
															SECAM UNITs (U3 and U3/IEEE), only PM 5418
11.1	SECAM L	COLOR BAR	CARR.OFF		1 V *	100 %		VIDEO OUT	Vecamscope** TTV 8300	adj. red vector to tolerance field 'R'	20	R626, U3	x		DR and DB deviation * set VIDEO AMPL to 1 V-pp at VIDEO OUTPUT ** Vecamscope setting: 'VE'
11.2	SECAM L								Vecamscope** TTV 8300	adjust blue to tolerance field 'B'	20	R611, U3	x		DB deviation
11.3	SECAM L								Vecamscope** TTV 8300	5 divisions*	21	R143, U11	x		Chroma amplitude * for different equipment use the SECAM color bar characteristics Fig. 20 ** Vecamscope setting: Chroma 'CHR'
11.4	SECAM L	COLOR BAR	CARR.OFF		1 V *	100 %		VIDEO OUT	Vecamscope** TTV 8300	adjust amplitudes to same value	21	L757, U3	x		Bell-shaped curve * set VIDEO AMPL to 1 V-pp at VIDEO OUTPUT ** Vecamscope setting: Chroma DB-components
11.5	SECAM L	WHITE						IC313 pin 15, U3	OSC, probe 10:1	level between 1.9 V to 3.6 V	22	L756, U3	x		DC-level at sampling times
11.6	SECAM L	WHITE, GREY SCALE	CARR.OFF	182.25	1 V	100 %	max.	RF OUTPUT	SPA	−20 dBc ±0.5 dB		R710, U11	x		Residual carrier (AM pos.), set RF amplitude to >10 mV ≙ 80 dBμV, no visual compression allowed of the linear demodulated video signal
11.7	SECAM L	WHITE	CARR. ON	182.25	1 V	100 %	max.	RF OUTPUT	SPA	11 dB ±1 dB				x	Ratio of vision to sound carrier
11.8	SECAM L	–	ON, 1 kHz					Unit 8, pin 5	OSC, TV	50 % ±3 %				x	AM sound modulation
11.9	SECAM L	WHITE	CARR.OFF					VIDEO OUT RF OUTPUT	OSC TV	see Figure 23	23			x	BW pattern; check center indication and luminance blanking
11.10	SECAM L	GREY SCALE, COLOR BAR, MULTI BURST, VCR	CARR.OFF					RF OUTPUT	TV, OSC Vecamscope	see Figure 24	24			x	Color patterns * check the analog luminance and color signal generation of Unit 3
11.11	SECAM L	GREY SCALE, COLOR BAR, MULTI BURST, DEM	CARR.OFF							see Figure 25	25			x	

	SETTINGS									MEASURING					
Seq.	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
12.0															**Teletext TOP/FLOF Unit (U4), Teletext PDC/CC Unit (U4/PDC)** For assignment to the different instrument versions see Figure 100. **UK-Teletext, Antiope, Closed Caption (CC)** Use TV receiver with teletext decoder, incl. TOP, FLOF, PDC function. For Antiope (France) and Closed Caption (USA) a special decoder is needed. For operating and contents of teletext pages see Operating Manual Chapter 6. For instruments with U4/PDC, see Chapter 7.
12.1	PAL G	Teletext	OFF	182.25	1 V	0 %	max.	RF OUTPUT	TV with Teletext decoder					x	Set Teletext switch to AUTO (rear panel) Select different pages via TV remote control: UK-Teletext
12.2	SECAM	Antiope												x	Antiope
12.3	NTSC	Closed Caption												x	Closed Caption (only Teletext U4/PDC)
12.4	PAL G	Page 100	OFF	182.25	1 V	0 %		D101 Pin 6, Unit 4 or D302 Pin 2, U4/PDC	C/T, with high impedance probe	6.937500 MHz ±70 Hz *				x	Teletext data clock, UK-Teletext, Frequencies are locked to master clock
12.5	SECAM									6.203125 MHz ±62 Hz * *f ±13 Hz				x	Teletext Antiope * only instruments with NICAM or IEEE-bus
12.6	NTSC M							D302 Pin 2, U4/PDC		1.006993 MHz ± 10 Hz * *f ±2 Hz				x	Closed Caption data clock (only U4/PDC) * only instruments with NICAM or IEEE-bus
12.7	PAL G	Page 100	OFF	182.25	1 V	0 %		VIDEO OUT	OSC, trigger with Line Sync	12.3 µs ± 0.7 µs	26			x	Data timing of teletext (start line sync to penultimate bit of clock run-in)
12.8	SECAM									10.5 µs ± 0.3 µs	27			x	Antiope (start line sync to half amplitude of first bit of clock run-in)
12.9	NTSC M									10.5 µs ± 0.5 µs	57			x	Closed Caption, Line 21 (only U4/PDC); start line snyc to leading edge of run-in signal
12.10	PAL G									460 mV ±20 mV	26	R128, Unit 4 (R123, U4/PDC)	x		Amplitude binary '1' (values related to blanking level) UK-Teletext
12.11	SECAM									700 mV + 0 mV −40 mV	27	R128, Unit 4 (R123, U4/PDC)	x		Antiope, iterate with Seq. 12.10
12.12	NTSC									357 mV ±15 mV *	57	R109, Unit 4/PDC	x		Closed Caption, (U4/PDC). * (7.14 mV = 1 IRE)
12.13	PAL G									0 V ±10 mV	26			x	Amplitude binary '0': UK-Teletext
12.14	SECAM									0 V ±15 mV	27			x	Antiope
12.15	NTSC									0 V ±10 mV	57			x	Closed Caption (only U4/PDC)
12.16	PAL G	Teletext + Greyscale	OFF	182.25	1 V	0 %		VIDEO OUT	OSC, trigger with Line Sync	check 1st/2nd field	26			x	Line selection UK-Teletext (Unit 4): 20, 21, 333, 334
12.17	PAL G									check 1st/2nd field	26			x	Unit 4/PDC: 13, 14, 20, 21 and 326, 327, 333, 334 (Unit 4)
12.18	SECAM									check 1st/2nd field	27			x	Line selection Antiope (Unit 4, Unit 4/PDC): 20, 21, 333, 334
12.19	NTSC									check 1st field	57			x	Line selection Closed Caption (only U4/PDC)

	SETTINGS									MEASURING					
Seq.	TV SYSTEM	PATTERN	VPS/PDC CODE	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
13.0															**Video Programme System (VPS)** **PDC Recording Control Function** For assignment to the different instrument versions see Figure 100. For operating VPS, PDC and contents see Operating Manual Chapter 7. VPS data are generated by the Digital Unit 1 (U1/VPS) and transmitted via TV line 16. Set the TOP/FLOF switch to TOP (rear panel). PDC data are stored on Unit 1/VPS, copied to the Teletext/PDC Unit (U4/PDC), and transmitted via Teletext. Set TOP/FLOF switch to FLOF. Check VPS or PDC functions by a suited VCR.
13.1	PAL G	GREY SCALE, COLOR BAR, MULTI BURST, DEM	VPS CODE 1	182.25	1 V *	100 %	max.	RF OUTPUT	TV	see Figure A	A			x	VPS function: set switch TOP/FLOF to TOP Initialization of VPS/PDC data, press keys: STORE CH STEP ▽ VPS Code 1 ON, press keys: RECALL VPS 1 VPS code in the TV picture, press keys: RECALL VPS CH (code visible or invisible depends on initial status of the instrument) Check the contents in the TV picture
13.2								VIDEO OUT	OSC, trigger with Line Sync	see Figure B	B			x	Check the contents of the TV line 16 * set VIDEO AMPLITUDE to 1 V-pp
13.3								RF OUTPUT	VCR with VPS function					x	Check the timer function by a VCR including VPS. See the manual of your VCR for operating the VCR.
13.4								VIDEO OUT	OSC, trigger with Line Sync	500 mV ±25 mV-pp	B			x	Signal level '1' of TV line 16, (values related to blanking level)
13.5								VIDEO OUT		0 V ±10 mV-pp	B			x	Signal level '0':
13.6	PAL G / I	GREY SCALE, COLOR BAR, MULTI BURST, DEM	PDC CODE 1	182.25	1 V	100 %	max.	RF OUTPUT	TV	see Figure C	C			x	PDC Function: set switch TOP/FLOF to FLOF PDC Code 1 ON, press keys: RECALL PDC 1 PDC code in the TV picture, press keys: RECALL PDC CH (depends on initial status of the instrument) Check the contents in the TV picture. The PDC data are part of the teletext data and transmitted in the TV lines for teletext.
13.7									VCR with PDC function					x	Check the timer function by a VCR including PDC function. See the manual of your VCR for operating the VCR.

Figure A Contents of VPS Code 1

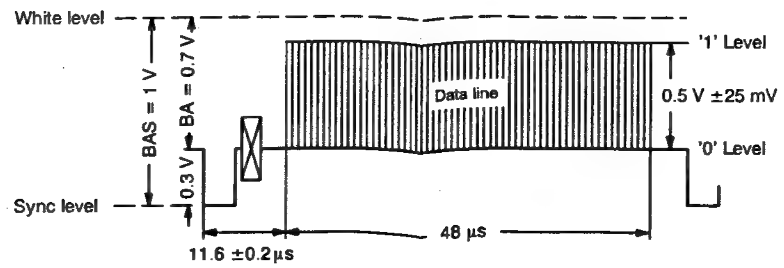


Figure B Level and Position of VPS Data Line (TV Line 16)

Figure C Contents of PDC Code 1

Seq.	SETTINGS									MEASURING					
	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
															RF UNIT 10 (only for experienced service workshops). The following table Seq. 14.1 to 14.21 should be used in case of faults and component replacements on U10. For access to parts remove upper screening cover.
14.1				32 to 89				Unit 10, pin 6 (AFC)	Vdc	3 V to ≤27 V		L801 , U10	x		**Tuning voltage range,** (AFC): VCO 1a
14.2				90 to 179						1.5 V to ≤27 V		L802 , U10	x		adjust core L801/802 VCO 1b
14.3				180 to 299						3 V to ≤27 V		L803*, U10	x		* adjust by bending approp. coil L803 to L810. VCO 1c
14.4				470 to 679						3 V to ≤27 V		L804*, U10	x		VCO 1d
14.5				680 to 900						3 V to ≤27 V		L805*, U10	x		VCO 1e
14.6				300 to 469						3 V to ≤27 V		L810*, U10	x		VCO 1f
14.7	PAL G	GREY SCALE	CARR. INT 1 kHz OFF	150	1 V	100 %	max.	RF OUTPUT •—	SPA**	20 dB■ ±3 dB		R627*, U10	x		**Residual carrier** (AM negative) * If necessary move position R627-630 or output coupling pt. (change soldering connection at the corresponding coil). No visual compression allowed of linear demodulated video signal. Adjustment influences intermodulation products fvc ±1.1 MHz, see Seq. 14.15 to 14.20. ** SPA setting: bandwidth approx. 1.5 MHz scanwidth zero (dispers./div).
14.8				200						20 dB■ ±3 dB		R628*, U10	x		
14.9				600						20 dB■ ±6 dB		R629*, U10	x		
14.10				750						20 dB■ ±6 dB		R630*, U10	x		
14.11				400						20 dB■ ±6 dB ■ NICAM versions are adjusted to 14 dB		R675*, U10	x		
14.12	SECAM L		CARR. INT 1 kHz ON	300 to 900			max. * or <10 mV	RF OUTPUT •—	SPA**	spurios signal ≤12 % of distance of neighbouring greyscale values		R629, R630, R675, U10	x		**SECAM L, 1 kHz spurious** modulated on video signal * depending on sensitivity of SPA do not overdrive the analyzer input ** SPA setting: bandwidth 1.5 MHz scanwidth zero scale linear
14.13	PAL G	VIDEO EXT	OFF	32 to 900			max.	RF OUTPUT •—	SPA	≥ 80 dBμV (10 mV)				x	**RF output level** (at 75 Ω)
14.14	PAL G	RED	CARR. INT 1 kHz OFF	90 to 179			max.	RF OUTPUT •—	SPA**, TV	≤ –55 dBc		R627*, U10	x		**Intermodulation products** (vision carrier to fvc ±1.1 MHz) * Move soldering connection at corresponding oscillator coil to high side; additionally check the residual carrier (see Seq. 14.7 to 14.11). ** SPA setting: bandwidth 120 kHz scanwidth 0.5 MHz
14.15				180 to 299						≤ –55 dBc		R628*, U10	x		
14.16				300 to 469						≤ –55 dBc		R675*, U10	x		
14.17				470 to 679						≤ –50 dBc		R629*, U10	x		
14.18				680 to 900						≤ –50 dBc		R630*, U10	x		
14.19		VIDEO EXT	OFF	32 to 299					SPA	±2 dBμV		R654, R655*, R656*, U10	x		**RF level flatness** * Adjustment serves for final matching influencing the residual carrier, video compression and intermodulation products, see Seq. 14.7 to 14.18.
14.20				300 to 469						±3 dBμV			x		
14.21				470 to 900						±2 dBμV			x		

Seq.	SETTINGS: TV SYSTEM	PATTERN	VIDEO AMPL	CHROMA AMPL	• Measuring Point/Unit	Measuring Instrument	MEASURING: Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
					REAR SIDE							**RGB & Y/C UNIT (U5)** If possible, use additional RGB-monitor
15.1	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT RED	OSC	Adjust amplitude to black/white level	31	R686, U5	x		Amplitude of multiburst pattern; Amplitude response ≤ 10 mV
15.2							0.7 V ±150 mV	31			x	DC-offset (VDCO)
15.3							0.7 V ±20 mV-pp	31			x	Signal amplitude
15.4	PAL/SECAM						see Fig.	31			x	Luminance PAL Y = 0.5; SECAM Y = 0.75
15.5							see Fig.	31,34			x	Check patterns (contents); Greyscale: equidistent steps; color bar
15.6					SYNC	OSC	−2.0 V ±0.2 V	43			x	Sync. pulse
15.7	PAL/NTSC				SUBCARRIER	OSC	1 V ±80 mV-pp				x	Amplitude subcarrier PAL/NTSC
15.8	PAL G, I				SUBCARRIER	COUNTER/TIMER	4.433619 MHz ±44 Hz*				x	Subcarrier frequencies,
15.9	PAL/NTSC				SUBCARRIER	COUNTER/TIMER	see. Seq. 4.3 to 4.5 *				x	for different systems see Seq. 4.3 to 4.5
							* fc ±7 Hz				x	* only instruments with NICAM or IEEE-bus
15.10	PAL/SECAM				OUTPUT RED	OSC	0.7 V ±20 mV-pp	44			x	Digital white
15.11	PAL I	COLOR BAR			OUTPUT RED	OSC	see Fig.	46			x	Color bar pattern, PAL I
15.12	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT GREEN	OSC	Amplitude at black/white level				x	Amplitude multiburst pattern; Amplitude response ≤ 10 mV
15.13							0.7 V ±150 mV	32			x	DC level (VDCO)
15.14							0.7 V ±20 mV-pp	32			x	Signal amplitude
15.15							see Fig.	32			x	Luminance PAL Y = 0.5, SECAM Y = 0.75
15.16							see Fig.	32,35			x	Check patterns (contents); Greyscale: equidistent steps; color bar
15.17	PAL/SECAM						0.7 V ±20 mV-pp	44			x	Digital white
15.18	PAL I	COLOR BAR					see Fig.	47			x	Color bar pattern, PAL I
15.19	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT BLUE	OSC	Amplitude at black/white level	33			x	Amplitude multiburst pattern; Amplitude response ≤ 10 mV
15.20							0.7 V ±150 mV	33			x	DC-offset (VDCO)
15.21							0.7 V ±20 mV-pp	33			x	Signal amplitude
15.22							see Fig.	33			x	Luminance PAL Y = 0.5, SECAM Y = 0.75

Seq.	SETTINGS						MEASURING					
	TV SYSTEM	PATTERN	VIDEO AMPL	CHROMA AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
												RGB & Y/C UNIT (U5) CONTINUED
15.23	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT BLUE	OSC	see Fig.	33,36			x	Check patterns (contents) Greyscale: equidistent steps; color bar
15.24	PAL/SECAM						0.7 V ±20 mV-pp	44			x	Digital white
15.25	PAL I	COLOR BAR					see Fig.	48			x	Color bar pattern, PAL I
15.26	NTSC				OUTPUT RED	OSC	V_{lift} = 54 ±5 mV	45			x	
15.27					OUTPUT GREEN		V_{lift} = 54 ±5 mV	45			x	Black level lift (NTSC, PAL M)
15.28					OUTPUT BLUE		V_{lift} = 54 ±5 mV	45			x	
15.29	PAL/SECAM	COLOR BAR			OUTPUT GREEN	OSC	V_{sync} = 0.3 V ±0.01 V	49			x	Sync in RGB signal GREEN set jumper X002 to ON
15.30	NTSC M				OUTPUT GREEN		V_{sync} = 0.28 V ±0.01 V	50			x	(on Unit 5)
												Y-signal (luminance) for luminance test with 75 Ω termination connect an RGB output cable to socket X822 to get to BNC connector
15.31	PAL G, I	GREY SCALE, COLOR BAR, MULTI BURST, DEM		100 %	OUTPUT Y/C *		1 V ±40 mV-pp	51			x	
												Luminance, total amplitude
15.32	NTSC M						1 V ±40 mV-pp	53			x	
15.33	SECAM L						1 V ±40 mV-pp	55			x	* see explanation below
15.34	SECAM L						0.7 V ±150 mV	55			x	
15.35	PAL G, I						0.7 V ±150 mV	51			x	Blanking level, DC position
15.36	NTSC M						0.7 V ±150 mV	53			x	
												Chroma signal, amplitude * for chroma test with 75 Ω termination connect an RGB output cable to socket X821 to get C-signal to BNC conncetor
15.37	PAL G, I	GREY SCALE, COLOR BAR, MULTI BURST, DEM		100 %	OUTPUT Y/C *	OSC	300 mV ±15 mV-pp	52			x	Amplitude of burst
15.38	NTSC M						285 mV ±15 mV-pp	54			x	Amplitude of burst
15.39	SECAM L	CYAN					460 mV ±40 mV-pp	56			x	Chroma amplitude purity CYAN

9 SAFETY INSPECTION AND TESTS AFTER REPAIR AND MAINTENANCE IN THE PRIMARY CIRCUIT

9.1 GENERAL DIRECTIVES

- Take care that creepage distance and clearances have not been reduced.
- Before soldering, bend the wires through the holes of the solder tags or wrapp the wires round the tag in the form of an open U, or maintain wiring rigidity by using cable clamps or cable lacing.
- Replace all insulating guards and plates.

9.2 SAFETY COMPONENTS

Components in the primary circuit may only be replaced by components selected by Fluke/Philips, see also Section 10.1.

9.3 CHECKING THE PROTECTIVE GROUND CONNECTION

The correct connection and condition is checked by visual control and by measuring the resistance between the protective-lead connection at the plug and the cabinet/frame. The resistance shall not be more than 0.5 Ω. During measurement the power cord should be moved. Resistance variations indicate a defect.

9.4 CHECKING THE INSULATING RESISTANCE

Measure the insulation resistance at U = 500 Vdc between the power connections and the protective lead connections. For this purpose set the power switch to ON. The insulation resistance shall not be less than 2 MΩ; 2 MΩ is a minimum requirement at 40 °C and 95 % relative humidity. Under normal conditions, the insulation resistance should be much higher (10 to 20 MΩ).

10 SPARE PARTS, FIGURES

10.1 GENERAL

The PM 5415 / PM 5418 Color TV Pattern Generators is repaired preferably to component level. If the fault cannot be found at the component level, the single units can be ordered.

Spare Parts must be ordered via Consumer Service PCS Eindhoven.

10.2 STANDARD PARTS

Electrical and mechanical parts replacements can be obtained through your local Fluke/Philips organization or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE: Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade instrument performance.

10.3 SPECIAL PARTS

In addition to the standard electronic components, the following special components are used:
- Components, manufactured or selected by Fluke/Philips to meet specific performance requirements.
- Components thart are important for the safety of the instrument are marked with 'S' in the parts list.

NOTE: Both type of components may only be replaced by components obtained through your local Fluke/Philips organization or representative.

10.4 TRANSISTORS AND INTEGRATED CIRCUITS

- If removed during routine maintenance, return transistors and IC's to their original positions.
- Do not replace or switch semiconductor devices unnecessarily, because this may affect the calibration of the instrument.
- Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket or pcb holes and cut the leads to the same lenght as on the component being replaced.
- When a part has been replaced, check the operation of the part of the instrument that may be affected.
- When reinstalling power-supply transistors, use heat-sink compound to increase the heat-transfer capabilities.

WARNING

To avoid skin irritation or injury, handle heat-sink compound with care. Avoid contact with the eyes. Wash hands thoroughly after use.

10.5 STATIC-SENSITIVE COMPONENTS

This instrument contains electrical components that are susceptible to damage from static discharge. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

10.6 HANDLING MOS DEVICES

Though all our MOS integrated circuits incorporate protection against electrostatic discharges, they can nevertheless be damaged by accidental overvoltages. In storing and handling them, the following precautions are recommended.

CAUTION

To avoid electric shock testing or handling and mounting call for special attention to personal safety. Personnel handling MOS devices should wear a ground strap.

10.6.1 Storage and Transport

Store and transport the circuits in their original packing. Alternatively, you can use a conductive material or a special IC carrier that either short-circuits all leads or insulates them from external contact.

10.6.2 Testing or Handling

Personnel must wear a ground strap and work on a conductive surface (e.g., metal table top) when testing the circuits or transferring them from one carrier to another. Connect all testing and handling equipment to the same surface.
Signals should not be applied to the inputs while the device power supply is off. All unused input leads should be connected either to the supply voltage or to ground.

10.6.3 Mounting

Mount MOS integrated circuits on printed circuit boards after all other components have been mounted. Take care that the circuits themselves, metal parts of the board, mounting tools, and the person doing the mounting are kept at the same electric (ground) potential. If it is impossible to ground the printed circuit board, the person mounting the circuits should touch the board before bringing the MOS circuits into contact with it.

10.6.4 Soldering

Soldering iron tips, including those of low voltage irons, or soldering baths should also be kept at the same potential as the MOS circuits and the board.

10.6.5 Static Charges

After the MOS circuits have been mounted, the proper handling precautions should still be observed. Until the subassemblies are inserted into the complete system in which the proper voltages are supplied, the board is no more than an extension of the leads of the devices mounted on the board. To prevent static charges from being transmitted through the board wiring to the device, it is recommended that conductive clips or conductive tape is put on the circuit board terminals.

10.6.6 Transient Voltages

To prevent permanent damage due to transient voltages, do not insert or remove MOS devices (or printed circuit boards with MOS devices) from test sockets or systems with power on.

10.7 SOLDERING TECHNIQUES

Working method:
- Carefully unsolder one after the other the soldering tags of the semiconductor.
- Remove all superfluous soldering material.
- Check that the tags of the replacement part are clean and pretinned in the areas where they are to be soldered.
- Locate the replacement semiconductor exactly in its place, and solder each tag to the relevant printed conductor on the circuit board.

NOTE: Bear in mind that the maximum permissible soldering time is 10 seconds during which the temperature of the tags must not exceed 250 °C. The use of solder with a low melting point is therefore recommended. Take care not to damage the plastic encapsulation of the semiconductor (softening point of the plastic is 150 °C).

WARNING

When you are soldering inside the instrument, it is essential to use a low-voltage soldering iron, the tip of which must be grounded to the instrument.

Suitable soldering irons should have temperature control and different types of nozzles (pin point tips), e.g., Weller Magnastat WTCP or WECP, Ersa TC 70/24V.
If a higher wattage-rating soldering iron is used on the etched circuit boards, excessive heat can cause the etched circuit wiring to separate from the board base material. In general use short-time heating with tip temperature at a small point; avoid long time heating.

10.7.1 Surface Mounted Devices (SMD) Handling and Replacement

Tools and Materials:

The removal and attachment method of SMD components mainly employs convection heating. This involves the application of hot air to the solder joints. For removing, nozzles are available for different size and shaped components. This permits the heat to be placed directly on the leads.
There are always two settings on the hot-air tool, one for temperature (50 ... 500 °C) and the other for the air flow.
Next, a mini soldering iron can be used to prepare the solder pads before attachment and to do any touchup work.

To ensure proper repair of the surface mounted devices, the following tools have been carefully selected and are therefore recommended:
- A hot-air solder tool: Leister Hot-Jet
- Nozzles for the different packages
- Micro Electronic Systems (MES) repair kit, containing dispenser, vacuum pipette and different caplettes
- Mini soldering iron station: WEPC-COD3 (regulated transformer) and Weller MLR-20 (mini soldering iron)

The following materials are recommended:
- Soldering tin, dia 0.8 mm, SnPb 60/40 with a Resin Midly Activated (RMA) flux.
  Ordering code: 4822 390 80133
- Solder past 026
- Non-corrosive and Resin Midly Activated (RMA) Flux-Colophony.
  Ordering code: 4822 390 50025
- Desolder braided wire; ordering code: 4822 321 40042
- Magnifying glass 3x ... 10x

NOTE: The recommended Leister tools and Weller mini soldering iron can be ordered via your local dealer.

Handling SMD

Electrostatic Discharge (ESD):
All integrated circuits and many semi-conductors are susceptible to ESD. Careless handling during repair can reduce life drastically. To prevent any failure which is caused by static damage, some precautions must be taken for
- transportation: use static shielding bags and containers
- working area: use anti-static mat and wristband, connected to earth potential.

Replacement of SMD:

CAUTION

Components once removed must NOT be used again.

Fluxing and Cleaning:

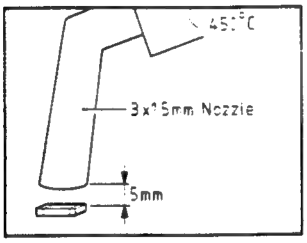
For optimal soldering result, solder flux must be used to chemically clean the metals and the solder. The flux removes oxide from the metals and acts as a wetting agent. Because the use of flux can cause electrical leakage problems in high-ohmic circuits, it is important to use non-corrosive and Resin Midly Activated (RMA) flux, such as Colophony.
The flux residue left over after attachment the SMD components must be removed. To ensure proper cleaning of the board, this must be done IMMEDIATELY after repair. The longer the flux remains on the board, the harder it is to clean.

Replacement of SMDs with up to four connections

NOTE: Before removing the component, observe very carefully its position to avoid that the new component is installed upside-down. This is especially important for capacitors and four-leads SOTs.

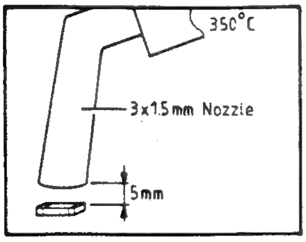
REMOVING:

ATTENTION: Be careful that the adjacent components are not damaged by the hot-air flow.



- Prepare the hot-air tool; attach a 3 x 1.5 mm oval tip nozzle, set the temperature of the hot gas to 450 °C and the air flow to 'high'.
- Hold the nozzle 5 mm above the component to be removed.
- Heat the component up equally for about 5 seconds.
- When the solder becomes molten, remove the component from the board using the vacuum pipette.
- Remove the hot-air tool.
- Clean all pads with the braided wire.

ATTACHING:

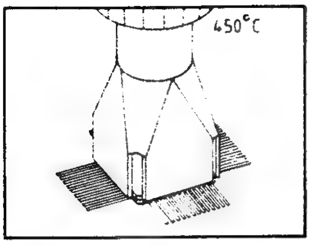


- Apply new solder paste in small dots to all soldering pads.
- Prepare the hot-air tool; use a 3 x 1.5 mm oval tip nozzle, set the hot gas to 350 °C and the air flow to 'low'.
- Place the new component with a pair of tweezers on the sticky solder paste of the contact pads.
- Position the component well.
- Apply the heat from a distance of 5 mm in the direction of the solder paste.
- Allow even reflow of the solder, the soldering time per joint should be not more than about 10 seconds.
- Remove the hot-air tool.
- Clean the pcb very carefully; be sure to remove all flux residue.
- Inspect the solder joints and, if necessary, remove superfluous solder rests with the use of braided wire.

Replacement of SMDs with more connections

REMOVING:

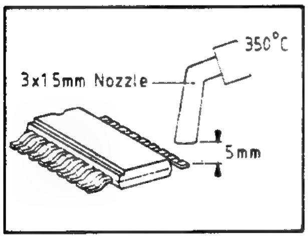
ATTENTION: Be careful that the adjacent components are not damaged by the hot-air flow.



- Prepare the hot-air tool; attach the correct nozzle, set the temperature of the hot gas to 450 °C and the air flow to 'high'.
- Hold the nozzle on the component to be removed.
- Heat all connections of the component equally up for about 10 seconds.
- When the solder becomes molten, remove the component from the board using the vacuum pipette. Use a small screwdriver to break the glue bond when necessary.
- Remove the hot-air tool.
- Clean all pads with the braided wire.

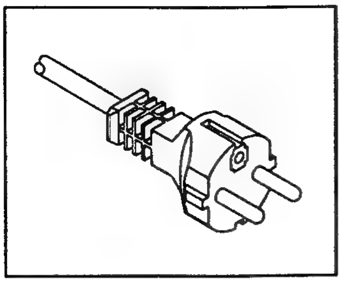
ATTACHING:

NOTE: It is very helpful to use a magnifying glass having a magnification of 3 to 10 to check the correct position of all leads.

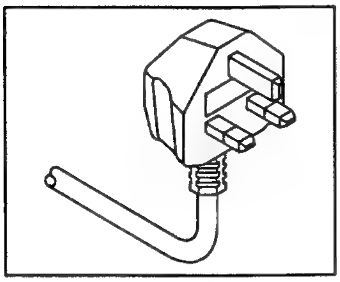


- Apply a certain amount of flux to the solder pads.
- Apply new solder paste in a straight line to the soldering pads.
- Prepare the hot-air tool; attach a 3 x 1.5 mm oval tip nozzle, set the temperature of the hot gas to 350 °C and the air flow to 'low'.
- Place the new component with a pair of tweezers on the sticky solder paste of the contact pads. Use the pin no. 1 location for reference.
- Fix the component with a small soldering tip by briefly heating soldering pads in two diagonally opposite corners.
- Apply the heat from a distance of 5 mm in the direction of the solder paste.
- Slowly move the nozzle over the row of solder joints.
- Allow even reflow of the solder, the soldering time per joint should be not more than about 10 seconds.
- Remove the hot-air tool.
- Clean the pcb very carefully; be sure to remove all flux residue.
- Inspect the solder joints for good connections or short-circuits and, if necessary, remove superfluous solder rests with the use of braided wire.

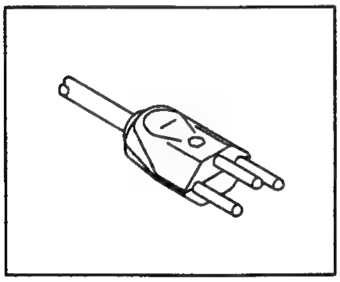
10.8 MAINS CABLES



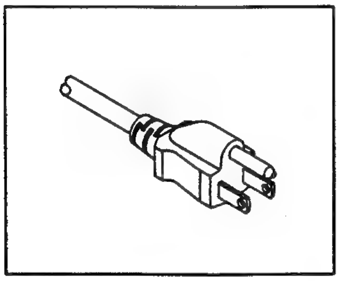
Europe, Schuko
5322 321 10755



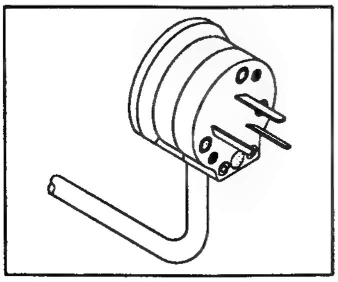
England, U.K.
5322 321 10756



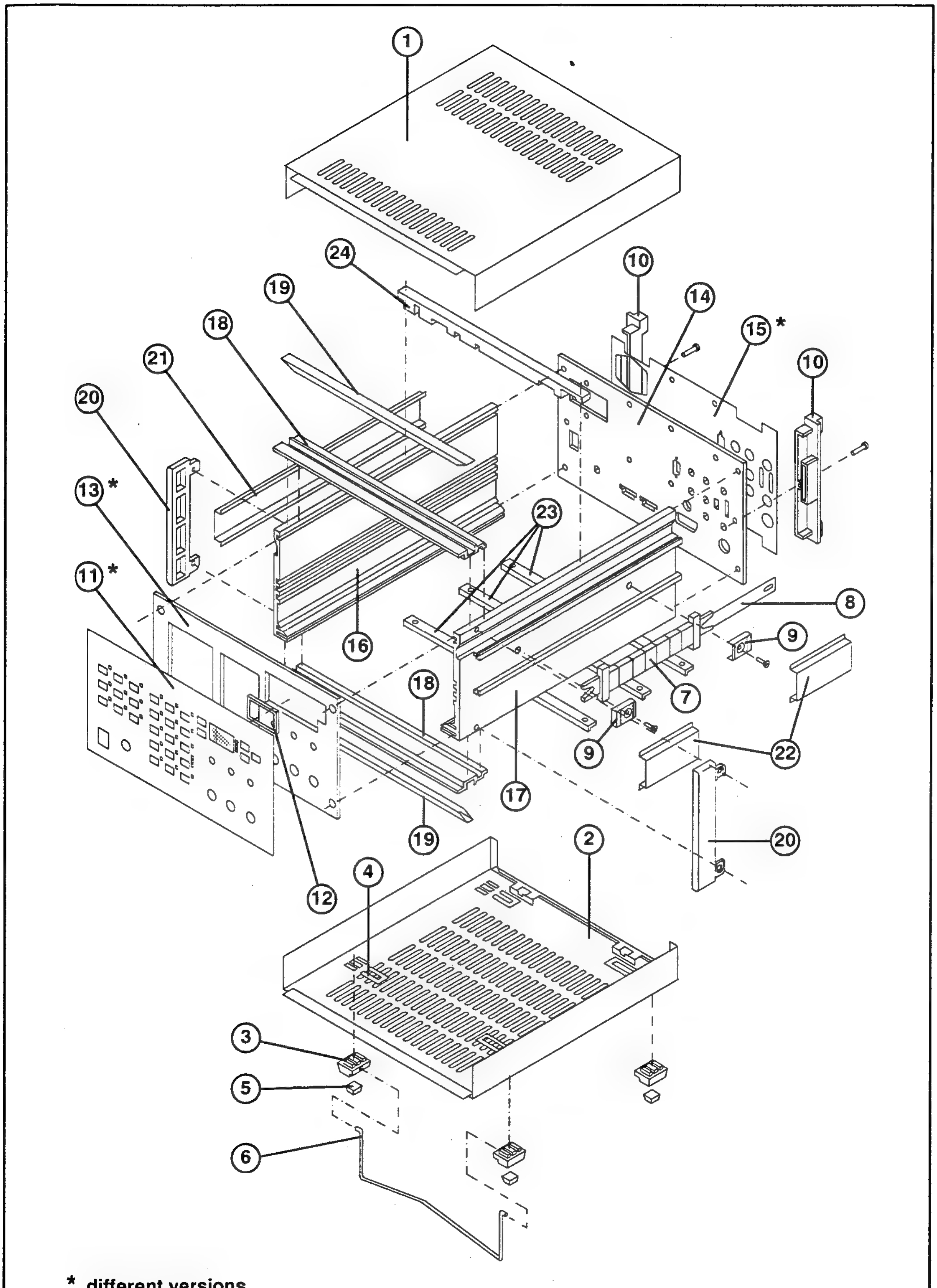
Switzerland
5322 321 10753



North America
5322 321 10752



Australia
5322 321 10754



* different versions

Fig. 10.1 Mechanical parts, housing

10.9 MECHANICAL PARTS, HOUSING (Figure 10.1)

Item	Quantity	Order number	Description
1	1	5322 447 92212	Cover
2	1	5322 447 92213	Bottom
3	4	5322 462 41554	Foot (bottom side)
4	4	5322 492 64745	Locking clip
5	4	5322 462 44434	Rubber foot
6	1	5322 405 90313	Tilting support
7	1	5322 498 50324	Handle (rubber part)
8	1	5322 462 40759	Steel insert for handle
9	2	5322 462 71444	Holder for handle
10	2	5322 466 62458	Foot (rear side)
11 a	1	5322 455 71077	Text plate PM 5415
11 b	1	5322 455 71082	Text plate PM 5415 TNS
11 c	1	5322 455 71078	Text plate PM 5415 TX
11 d	1	5322 455 71081	Text plate PM 5415 TN
11 e	1	5322 455 71079	Text plate PM 5415 TXS
11 f	1	5322 455 71083	Text plate PM 5418
11 g	1	5322 455 71084	Text plate PM 5418 TX
11 h	1	5322 455 71085	Text plate PM 5418 TXS
11 i	1	5322 455 71088	Text plate PM 5418 TXI
11 k	1	5322 455 71086	Text plate PM 5418 TN
11 m	1	5322 455 71087	Text plate PM 5418 TNS
11 n	1	5322 455 71089	Text plate PM 5418 TNSI
12	1	5322 255 41321	Frame for display
13 a	1	5322 447 92169	Front plate PM 5415/18
13 b	1	5322 447 92205	Front plate PM 5415/18 NICAM
14	1	5322 447 92206	Rear plate
15 a	1	5322 456 90454	Textfoil for rear plate PM 5415/18
15 b	1	5322 456 90455	Textfoil for rear plate PM 5415/18 NICAM
16	1	5322 447 92208	Side panel left
17	1	5322 447 92207	Side panel right
18	2	5322 466 62457	Profile ornament
19	2	5322 466 93337	Plastic strip top and bottom
20	2	5322 447 92214	Side piece
21	1	5322 466 62463	Plastic piece left (long)
22	2	5322 466 62462	Plastic piece right (short)
23	3	5322 462 30578	Unit holder (motherboard)
24	1	5322 405 91656	Bracket for units

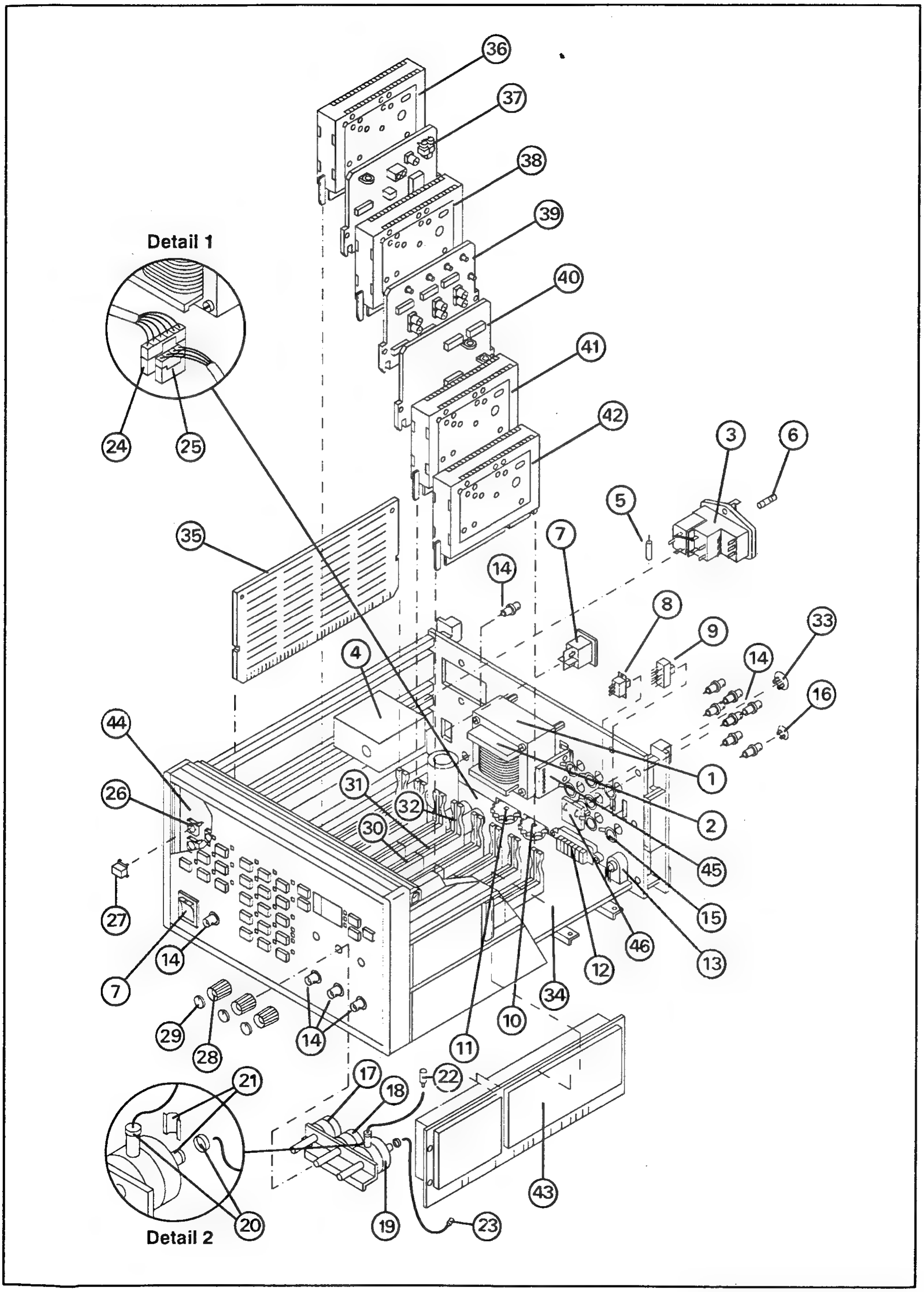


Fig. 10.2 Mechanical parts on units, cables, miscellaneous

10.10 MECHANICAL PARTS ON UNITS, CABLES, PARTS NOT ON UNITS; MISCELLANEOUS (Fig. 10.2)

Pos. No.		Description		Ordering Code
1	(A751)	TRANSFORMER	*S*	5322 146 21243
2		COVER FOR TRANSFORMER	*S*	5322 466 62461
3	(X812)	MAINS SOCKET	*S*	5322 121 43938
4		COVER FOR MAINS SOCKET	*S*	5322 462 41709
5	(R605)	HIGH VOLTAGE RESISTOR	*S*	4822 053 20475
6	(F800)	FUSE 630 MAT	*S*	4822 070 36301
	(F800)	FUSE 315 MAT	*S*	4822 070 33151
7	(S811)	MAINS SWITCH	*S*	5322 276 12029
8	(S871)	SLIDE SWITCH TOP/FLOF		5322 277 30949
9	(S872)	SLIDE SWITCH TELETEXT		5322 277 30951
10	(S801)	THUMBWHEEL SWITCH NTSC/PAL		5322 273 20238
11	(S802)	THUMBWHEEL SWITCH SECAM		5322 273 20239
12	(X888)	SCART CONNECTOR		5322 265 51157
13	(X889)	DIN-CONNECTOR AUDIO IN		5322 267 40687
14		BNC CONNECTOR		5322 267 10004
15		SOLDERING TAG FOR BNC		5322 290 30318
16		CAP FOR BNC CONNECTOR		5322 414 70182
17	(R601)	POTM/SWITCH VIDEO 1K 20% LIN 0.25W		5322 101 40134
18	(R602)	POTM/SWITCH CHROMA 10K 20% LIN 0.25W		5322 101 40135
19	(R753)	RF ATTENUATOR 75R		5322 105 40007
20		SOLDERING CAP ATTENUATOR		5322 462 50503
21		SPRING FOR ATTENUATOR		5322 492 71478
22		SHIELDING CAP FOR RF OUTPUT		5322 466 62464
23		COAX CABLE 50 OHM		5322 321 21907
24		CABLE AND CONNECTOR TRANSFORMER-U11		5322 321 62415
	(X151)	CONNECTOR FOR POS.24 (MALE 12 PINS)		5322 265 40465
25		CABLE AND CONNECTOR KEYBOARD-U11		5322 321 62345
	(X152)	CONNECTOR FOR POS.25 (MALE 7 PINS)		5322 265 40594
26		KEY (PUSHBUTTON)		4822 276 11076
27		CAP FOR KEY DARK GREY		5322 414 70185
		CAP FOR KEY GREY		5322 414 70184
28		KNOB		5322 414 60792
29		CAP FOR KNOB		5322 462 41701
30		CONNECTOR FOR U2-U8, 26 PINS		5322 267 60187
		CONNECTOR FOR UNIT 1, 29 PINS		5322 267 60186
31		CONNECTOR FOR U2-U8, 14 PINS		5322 267 50674
		CONNECTOR FOR UNIT 1, 17 PINS		5322 267 50673
32		LOCKING CLIP FOR UNIT		5322 401 10992
33		CAP FOR Y/C CONNECTOR		5322 413 70284

S = SAFETY COMPONENT

Pos. No.	Description	Ordering Code
UNITS COMPLETE		
34	MOTHERBOARD PM5415/18 (U11)	5322 214 91342
35	DIGITAL UNIT 16:9 (U1)	5322 214 91354
35A	DIGITAL UNIT / VPS (U1/VPS)	5322 214 91353
36	PAL-NTSC UNIT (U2)	5322 214 91343
36A	PAL-NTSC UNIT TXI/TN (U2/IEEE)	5322 214 91348
37	SECAM UNIT (U3)	5322 214 91347
37A	SECAM UNIT TXI/TNSI (U3/IEEE)	5322 214 91357
38	TELETEXT TOP/FLOF (U4)	5322 214 91352
38A	TELETEXT PDC (U4/PDC)	5322 214 91355
39	RGB & Y/C UNIT (U5)	5322 214 91351
40	MULTIBURST (U6)	5322 216 61577
40A	MULTIBURST TXI/TNSI (U6/IEEE)	5322 214 91349
41	LF STEREO UNIT (U7/ST)	5322 214 91344
42	RF STEREO UNIT (U8/ST)	5322 214 91345
41A+42A	TWIN-RF/LF TWIN SET (U7/TWIN+U8/TWIN)	5322 214 91358
42B	MONO SOUND UNIT (U8)*	5322 214 91346
43	RF UNIT (U10)	5322 214 91337
44	KEYBOARD UNIT (U12)	5322 214 91336
44A	KEYBOARD UNIT NICAM (U12/N)	5322 214 91341
	IEEE-BUS UNIT (U13) (NOT SHOWN)	5322 214 91338
45	IIC-BUS ADAPTER (U13A)	5322 214 91339
46	Y/C CONNECTOR UNIT, WIRED	5322 216 61503
CABLES		
--	INTERFACE CABLE (U13 TO PM 5418 TXI/TNSI)	5322 321 21716
--	S-VHS CABLE	5322 321 60789
--	RF CONNECTION CABLE BNC-TV	PM 9538

* INSTRUMENTS WITH MONO SOUND DO NOT HAVE ANY UNIT 7

Pos. No.	Description		Ordering Code

10.11 ELECTRICAL PARTS ON UNITS AND COMPLETE UNITS

MOTHERBOARD (U11)

UNIT 11 COMPLETE		5322 214 91342

INTEGRATED CIRCUITS / U11

D311	INTEGR.CIRCUIT	M80C85A-2	5322 209 73736
D312	INTEGR.CIRCUIT	SN74LS373N	5322 209 71261
D313	EPROM CPU	(STANDARD INSTR.)	5322 209 52514
D313	EPROM CPU	(INSTR. WITH NICAM)	5322 209 52519
D314	INTEGR.CIRCUIT	MSM81C55RS	5322 209 12271
D315	INTEGR.CIRCUIT	PCF8583P/F4	4822 209 73197
D316	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341
D321	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D322	INTEGR.CIRCUIT	HEF4011BD	4822 209 10247
D323	INTEGR.CIRCUIT	HEF4050BP	4822 209 10261
D325	INTEGR.CIRCUIT	HEF4011UBP	5322 209 82504
D326	INTEGR.CIRCUIT	PC74HC4049P	5322 209 11341
D327-D329	INTEGR.CIRCUIT	74HC4050N	5322 209 33188
D331	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
N301	INTEGR.CIRCUIT	LM78GCP	4822 209 30093
N302	INTEGR.CIRCUIT	LM79GCP	4822 209 30094
N304	INTEGR.CIRCUIT	LM317T	4822 209 80591
N318	INTEGR.CIRCUIT	SAB3036/C1	4822 209 73601
N324	INTEGR.CIRCUIT	SAA1043P	5322 209 81468
N330	INTEGR.CIRCUIT	LM324N	4822 209 80587
N335-N338	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N393	INTEGR.CIRCUIT	MC1458N	4822 209 81349

TRANSISTORS / U11

V305	TRANSISTOR	BC337-16	4822 130 41095
V319	TRANSISTOR	BC558B	4822 130 44197
V333	TRANSISTOR	BC558B	4822 130 44197
V339,V340	TRANSISTOR	BC548B	4822 130 40937
V341	TRANSISTOR	BC558B	4822 130 44197
V342	TRANSISTOR	BF246B	5322 130 44863
V343,V344	TRANSISTOR	BC548B	4822 130 40937
V345-V348	TRANSISTOR	BF246B	5322 130 44863
V349,V350	TRANSISTOR	BC548B	4822 130 40937
V351-V353	TRANSISTOR	BC558B	4822 130 44197
V354	TRANSISTOR	BC338	4822 130 44121
V355	TRANSISTOR,CHIP	BC858B	5322 130 41983
V390,V391	TRANSISTOR	BF240	4822 130 40902
V392	TRANSISTOR	BF494	4822 130 44195
V394	TRANSISTOR	BC548B	4822 130 40937
V395	TRANSISTOR	BC558B	4822 130 44197
V396	TRANSISTOR	BF240	4822 130 40902

Pos. No.	Description				Ordering Code
V397,V398	TRANSISTOR	BC548B			4822 130 40937
V399	TRANSISTOR	BF240			4822 130 40902
V400	TRANSISTOR	BF246B			5322 130 44863
V401	TRANSISTOR	PC40			5322 130 83608
V402	BRIDGE RECT.	KBU8K			4822 130 50438
V403-V406	RECTIFIER	BYV95B			4822 130 41486
V407	DIODE,REFERENCE	BZX79-B6V8			4822 130 34278
V411-V423	DIODE	BAW62			4822 130 30613
V429	DIODE,REFERENCE	BZX79-B30			4822 130 34328
V431-V440	DIODE	BAW62			4822 130 30613
V442	DIODE,REFERENCE	BZX79-B6V2			4822 130 34167
V443,V445	DIODE,REFERENCE	BZX79-B4V7			4822 130 34174
V444	DIODE,REFERENCE	BZX79-B5V6			4822 130 34173
V455	DIODE,REFERENCE	BZV55-B3V0			4822 130 82886
V462	DIODE,REFERENCE	BZX79-B5V6			4822 130 34173
V463	DIODE	BAW62			4822 130 30613
V464	DIODE,REFERENCE	BZX79-B6V8			4822 130 34278

CAPACITORS / U11

C214	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C215	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C216,C217	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C218	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C200	CAP.CHIP	100PF	2%	63V	4822 122 31765
C220	CAP.FOIL	220NF	5%	63V	4822 121 42408
C221	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C222	CAP.CERAMIC	2,2PF	0,25PF	100V	4822 122 31036
C223	CAP.TANTAL	10UF	20%	16V	5322 124 10675
C224	CAP.CERAMIC	680PF	10%	100V	5322 122 32052
C225	CAP.TANTAL	10UF	20%	16V	5322 124 10675
C226,C227	CAP.CERAMIC	10NF		100V	4822 122 31414
C228	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C501	CAP.ELECTROLYT.	10000UF	20%	25V	5322 124 70411
C502	CAP.ELECTROLYT.	47UF	20%	25V	4822 124 40433
C503-C505	CAP.ELECTROLYT.	22UF		100V	4822 124 40764
C506	CAP.ELECTROLYT.	2200UF	50%	40V	4822 124 21324
C507,C508	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C509	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C510	CAP.ELECTROLYT.	2200UF	50%	40V	4822 124 21324
C511,C512	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C513	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C514	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C517	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C518	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C519	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C520	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C522	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C523,C524	CAP.CERAMIC	47PF	2%	100V	4822 122 31072
C525	CAP.ELECTROLYT.	4,7UF	20%	63V	4822 124 40246
C526,C529	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C531	CAP.CERAMIC	18PF	2%	100V	4822 122 31061

Pos. No.	Description				Ordering Code
C532	CAP.FOIL	1UF	10%	100V	5322 121 40197
C533	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C534	CAP.CERAMIC	1,5NF	10%	500V	4822 122 31169
C536	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C537	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C538	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C539	CAP.CERAMIC	47PF	2%	100V	4822 122 31072
C540	CAP.CHIP	47PF	2%	63V	4822 122 31772
C541,C542	CAP.TRIMMER	1P8-22P		250V	4822 125 50045
C543,C544	CAP.CERAMIC	27PF	2%	100V	4822 122 30045
C545,C546	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C547-C549	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C550	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C551-C554	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C555	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C556	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C558	CAP.CERAMIC	27PF	2%	100V	4822 122 30045
C559,C560	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C561	CAP.CERAMIC	0,68PF	0,25PF	500V	4822 122 31213
C562	CAP.CERAMIC	47PF	2%	100V	4822 122 31072
C564	CAP.CERAMIC	27PF	2%	100V	4822 122 30045
C565	CAP.CERAMIC	220PF	10%	100V	4822 122 30094
C567	CAP.CERAMIC	33PF	2%	100V	5322 122 32072
C568	CAP.FOIL	470NF	5%	63V	4822 121 51252
C569	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C570	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C571	CAP.CERAMIC	1,8PF	0,25PF	100V	5322 122 32313
C572	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C573	CAP.CERAMIC	1,5PF	0,25PF	100V	5322 122 32101
C574,C575	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C576	CAP.CERAMIC	2,2PF	0,25PF	100V	4822 122 31036
C577	CAP.CHIP	3,3PF	0,25PF	100V	4822 122 31821
C578	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434

RESISTORS / U11

R140	RES.METAL FILM	21K5	1%	0,25W	5322 117 10933
R141	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R142	RES.METAL FILM	1K47	1%	0,4W	5322 117 10976
R143	POTM.TRIMMER	470E	CARB LIN	0,1W	4822 100 10038
R144	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R145	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R146	RES.METAL FILM	383R00	1%	0,4W	4822 050 13831
R547	RES.METAL FILM	2K61	1%	0,4W	5322 117 10992
R148	RES.METAL FILM	1K47	1%	0,4W	5322 117 10976
R149	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R150,R151	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R152	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R153	POTM.TRIMMER	100E	CARB LIN	0,1W	4822 100 10075
R154	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R155	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R156	POTM.TRIMMER	22K	CARB LIN	0,1W	4822 100 10051
R157	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975

Pos. No.	Description				Ordering Code
R158	RES.METAL FILM	422R	1%	0,25W	5322 117 10906
R159	RES.METAL FILM	1K78	1%	0,25W	5322 117 10885
R161	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R162	RES.METAL FILM	5K90	1%	0,4W	4822 050 15902
R163	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R164	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R165	RES.METAL FILM	5K90	1%	0,4W	4822 050 15902
R166	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R167	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R168	RES.METAL FILM	866R00	1%	0,4W	4822 050 18661
R169	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R170	RES.METAL FILM	1K54	1%	0,4W	4822 050 11542
R171	RES.METAL FILM	7K15	1%	0,4W	5322 117 11015
R172	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R173	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R174	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R175	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R176	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R177	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R178,R179	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R181	RES.METAL FILM	8K66	1%	0,4W	5322 117 10793
R182	RES.METAL FILM	6K49	1%	0,4W	5322 117 10796
R183	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R184	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R185-R187	RES.METAL FILM	332R	1%	0,25W	5322 117 10934
R194	RES.METAL FILM	464R00	1%	0,4W	4822 050 14641
R601,R603	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R604	RES.METAL FILM	3K32	1%	0,4W	4822 050 13322
R605	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R606	POTM.TRIMMER	1K	CARB LIN	0,1W	4822 100 10037
R607	RES.METAL FILM	2K61	1%	0,4W	5322 117 10992
R608	RES.METAL FILM	3K01	1%	0,4W	4822 050 13012
R609	RES.METAL FILM	1K62	1%	0,4W	5322 117 10979
R610	RES.METAL FILM	5K62	1%	0,4W	4822 050 15622
R611	POTM.TRIMMER	1K	CARB LIN	0,1W	4822 100 10037
R612	POTM.TRIMMER	100E	CARB LIN	0,1W	4822 100 10075
R613	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R614	RES.METAL FILM	205R00	1%	0,4W	4822 050 12051
R621	RES.METAL FILM	51K10	1%	0,4W	4822 050 15113
R622	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R623-R626	RES.METAL FILM	4K64	1%	0,4W	4822 050 14642
R627,R628	RES.NETWORK	4.7K			5322 116 90624
R629	RES.METAL FILM	4K64	1%	0,4W	4822 050 14642
R630	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R631	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R632	RES.METAL FILM	7K50	1%	0,4W	4822 050 17502
R633	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R634	RES.METAL FILM	5R11	1%	0,4W	5322 117 10786
R635	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R636	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R637	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R638,R640	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R639	RES.METAL FILM	1K27	1%	0,4W	5322 117 10974

Pos. No.	Description				Ordering Code
R641	RES.METAL FILM	1K27	1%	0,4W	5322 117 10974
R642	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R643	RES.METAL FILM	316K	1%	0,4W	5322 117 10949
R644	RES.METAL FILM	23K7	1%	0,4W	5322 117 10989
R645	RES.METAL FILM	95K3	1%	0,4W	5322 117 10963
R646	RES.METAL FILM	42K20	1%	0,4W	4822 050 14223
R647	RES.METAL FILM	82K50	1%	0,4W	4822 050 18253
R648	RES.METAL FILM	169K	1%	0,4W	5322 117 10964
R649	RES.METAL FILM	53K60	1%	0,4W	4822 050 15363
R650	RES.METAL FILM	105K	1%	0,4W	5322 117 11018
R651	RES.METAL FILM	287K	1%	0,4W	5322 117 10994
R652	RES.METAL FILM	133K00	1%	0,4W	4822 050 11334
R653	RES.METAL FILM	261K00	1%	0,4W	4822 050 12614
R654	RES.METAL FILM	715K	1%	0,4W	5322 117 10959
R655	RES.METAL FILM	47K5	1%	0,4W	5322 117 10953
R656	RES.METAL FILM	56K20	1%	0,4W	4822 050 15623
R657	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R658	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R659	RES.METAL FILM	5R11	1%	0,4W	5322 117 10786
R663	RES.METAL FILM	115K	1%	0,4W	5322 117 10774
R664	POTM.TRIMMER	47K	CARB LIN	0,1W	4822 100 10079
R665	RES.METAL FILM	10K7	1%	0,4W	5322 117 10935
R666	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R667	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R668	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R669	RES.METAL FILM	2K61	1%	0,4W	5322 117 10992
R670	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R671	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R672	RES.METAL FILM	442R00	1%	0,4W	4822 050 14421
R673	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R674	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R675	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R676	POTM.TRIMMER	1K	CARB LIN	0,1W	4822 100 10037
R677	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R678	RES.METAL FILM	825K	1%	0,4W	5322 117 10792
R679	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R680	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R681	RES.METAL FILM	825K	1%	0,4W	5322 117 10792
R682	RES.METAL FILM	953R	1%	0,4W	5322 117 10794
R683-R685	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R686	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R687	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R688	RES.METAL FILM	2K15	1%	0,4W	4822 050 12152
R689	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R691	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R692	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R693	RES.METAL FILM	1K05	1%	0,4W	5322 117 10972
R694	RES.METAL FILM	1K40	1%	0,4W	4822 050 11402
R695	RES.METAL FILM	1K27	1%	0,4W	5322 117 10974
R696	POTM.TRIMMER	2K2	CARB LIN	0,1W	4822 100 10029
R697	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R698	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R699	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119

Pos. No.	Description				Ordering Code
R700	RES.METAL FILM	1K78	1%	0,4W	5322 117 10983
R701	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R702	RES.METAL FILM	590R	1%	0,4W	5322 117 10954
R703	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R704	RES.METAL FILM	1K15	1%	0,4W	5322 117 10773
R705,R707	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R706	RES.METAL FILM	261R00	1%	0,4W	4822 050 12611
R709	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R710	POTM.TRIMMER	470E	CARB LIN	0,1W	4822 100 10038
R711	RES.METAL FILM	422R	1%	0,4W	5322 117 10952
R712,R713	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R714	RES.METAL FILM	17K8	1%	0,4W	5322 117 10944
R715	RES.METAL FILM	18K7	1%	0,4W	5322 117 10984
R716	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R717	POTM.TRIMMER	1K	CARB LIN	0,1W	4822 100 10037
R718,R719	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R720	RES.METAL FILM	1K69	1%	0,4W	4822 050 11692
R721	RES.METAL FILM	1K69	1%	0,4W	4822 050 11692
R722	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R723	RES.METAL FILM	1K33	1%	0,4W	4822 050 11332
R724	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R725	RES.METAL FILM	536R	1%	0,4W	5322 117 10787
R726	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R727	RES.METAL FILM	169R00	1%	0,4W	4822 050 11691
R728,R729	RES.METAL FILM	1K27	1%	0,4W	5322 117 10974
R730	RES.METAL FILM	536R	1%	0,4W	5322 117 10787
R731	RES.METAL FILM	1K54	1%	0,4W	4822 050 11542
R732,R734	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R735	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R736	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R737	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R738	RES.METAL FILM	115R	1%	0,4W	5322 117 10937
R739	RES.METAL FILM	3K48	1%	0,4W	4822 050 13482
R740	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R741	RES.METAL FILM	750R00	1%	0,4W	4822 050 17501
R781-R783	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002

RESISTORS FROM U11 TO CONTROLS AT THE FRONT PLATE

R160	RES.METAL FILM	82R50	1%	0,6W	4822 050 28259
R611	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R612	RES.METAL FILM	499R00	1%	0,6W	4822 050 24991
R613	RES.METAL FILM	75R00	1%	0,6W	4822 050 27509

COILS / U11

L805	COIL	22,8UH	5322 157 52793
L806	COIL	7,1UH	5322 157 52794

Pos. No.	Description		Ordering Code

CRYSTALS / U11

G881	CRYSTAL 5,034964 MHZ (STANDARD INSTR.)	5322 242 71607
G882	CRYSTAL 5,000000 MHZ (STANDARD INSTR.)	5322 242 73761
G881	CRYSTAL 5,034964 MHZ (NICAM, IEEE INSTR.)	5322 242 81696
G882	CRYSTAL 5,000000 MHZ (NICAM, IEEE INSTR.)	5322 242 81697
G883,G884	CRYSTAL 4,0 MHZ	4822 242 70668
G886	CRYSTAL 32,768 KHZ	5322 242 71466

MISCELLANEOUS / U11

G885	LITHIUM BATTERY 3 V	5322 138 10088
K880	REED RELAY	5322 280 20266
X888	SCART CONNECTOR	5322 265 51157
X889	DIN-CONNECTOR AUDIO IN	5322 267 40687
X101-X106	CONNECTOR FOR U2-U8, 26 PINS	5322 267 60187
X107	CONNECTOR FOR UNIT 1, 17 PINS	5322 267 50673
X108,X109	CONNECTOR FOR UNIT 1, 29 PINS	5322 267 60186
X110	CONNECTOR FOR U2-U8, 26 PINS	5322 267 60187
X111-X116	CONNECTOR FOR U2-U8, 14 PINS	5322 267 50674
X120	CONNECTOR FOR U2-U8, 14 PINS	5322 267 50674
X151	CONNECTOR MALE 12 PINS	5322 265 40465
X152	CONNECTOR MALE 7 PINS	5322 265 40594
X313	IC SOCKET (PLCC)	5322 255 41319

DIGITAL UNIT / U1

UNIT 1 COMPLETE 5322 214 91354

INTEGRATED CIRCUITS / U1

D101	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341
D102	INTEGR.CIRCUIT	PC74HCT86P	5322 209 11473
D104	INTEGR.CIRCUIT	PC74HCT109P	5322 209 11475
D105,D106	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D107	INTEGR.CIRCUIT	PC74HCT109P	5322 209 11475
D108	INTEGR.CIRCUIT	PC74HCT02P	5322 209 11106
D109	INTEGR.CIRCUIT	INTEGR.CIRCUIT	5322 209 11266
D110,D111	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D112	INTEGR.CIRCUIT	PC74HCT393P	4822 209 83045
D113	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D114	DIG.PATTERN PROM 1		5322 209 52511

Pos. No.	Description		Ordering Code
D115	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109
D116	INTEGR.CIRCUIT	PC74HCT356P	5322 209 71652
D117	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D118	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D119,D120	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105
D121	INTEGR.CIRCUIT	PC74HC00T	5322 209 71802
D122	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D123	INTEGR.CIRCUIT	PC74HC21T	5322 209 60437
D124	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D125	DIG.PATTERN PROM 2		5322 209 52515
D130	INTEGR.CIRCUIT	SN74LS37N	4822 209 80916
D202	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D205	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D206	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341
D207	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105
D208	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D209	ANALOG PATTERN PROM (STANDARD INSTR.)		5322 209 52509
D209	ANALOG PATTERN PROM (IEEE INSTR. ONLY)		5322 209 52518
D210	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D211	INTEGR.CIRCUIT	PC74HCT174P	5322 209 11478
D212	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D213	INTEGR.CIRCUIT	PC74HCT11P	4822 209 11427
D214-D216	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D301	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D302-D306	INTEGR.CIRCUIT	PC74HC08T	5322 209 71564

CAPACITORS / U1

C101-C125	CAP.CHIP	22NF	10%	63V	4822 122 31797
C151	CAP.ELECTROLYT.	47UF	20%	35V	4822 124 40846
C152	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C202-C213	CAP.CHIP	22NF	10%	63V	4822 122 31797

RESISTORS / U1

R101	RES.METAL FILM	21K5	1%	0,25W	5322 117 10933
R102	RES.METAL FILM	1K47	1%		5322 116 83691
R201	RES.METAL FILM	4K64	1%		5322 116 83698

MISCELLANEOUS / U1

X114,X125	IC SOCKET 32-P	4822 255 40921
X209	IC SOCKET (PLLCC)	5322 255 41319
X201,X202	CONNECTOR 3-P MALE	5322 267 41135
X801,X802	CONNECTOR 3-P MALE	5322 267 41135
	JUMPER FOR X201,X202,X801,X802	5322 263 60062

Pos. No.	Description		Ordering Code

DIGITAL UNIT VPS (U1/VPS)

UNIT 1/VPS COMPLETE		5322 214 91353

INTEGRATED CIRCUITS / U1 VPS

D101	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341
D102	INTEGR.CIRCUIT	PC74HCT86P	5322 209 11473
D103	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105
D104	INTEGR.CIRCUIT	PC74HCT109P	5322 209 11475
D105,D106	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D107	INTEGR.CIRCUIT	PC74HCT109P	5322 209 11475
D108	INTEGR.CIRCUIT	PC74HCT02P	5322 209 11106
D109	INTEGR.CIRCUIT	INTEGR.CIRCUIT	5322 209 11266
D110,D111	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D112	INTEGR.CIRCUIT	PC74HCT393P	4822 209 83045
D113	INTEGR.CIRCUIT	SN74LS161AN-00	5322 209 85915
D114	DIG.PATTERN PROM 1		5322 209 52516
D115,D118	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109
D116	INTEGR.CIRCUIT	PC74HCT356P	5322 209 71652
D117	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D119-D121	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105
D122	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D123	INTEGR.CIRCUIT	PC74HCT21P	5322 209 11491
D124	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D125	DIG.PATTERN PROM 2		5322 209 52517
D201	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D202	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D203	INTEGR.CIRCUIT	PC74HCT74P	5322 209 11109
D204	INTEGR.CIRCUIT	PC74HCT32P	5322 209 11266
D205	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D206	INTEGR.CIRCUIT	PC74HCT04P	4822 209 82341
D207	INTEGR.CIRCUIT	PC74HCT00P	5322 209 11105
D208	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D209	ANALOG PATTERN PROM (STANDARD INSTR.)		5322 209 52509
D209	ANALOG PATTERN PROM (IEEE INSTR. ONLY)		5322 209 52518
D210,D212	INTEGR.CIRCUIT	74HCT273N	5322 209 11485
D211	INTEGR.CIRCUIT	PC74HCT174P	5322 209 11478
D213	INTEGR.CIRCUIT	PC74HCT11P	4822 209 11427
D214-D216	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D301-D306	INTEGR.CIRCUIT	PC74HCT08P	5322 209 11265
D401	INTEGR.CIRCUIT	PCF8574AP	4822 209 63896
D402-D404	INTEGR.CIRCUIT	PCF8574P	5322 209 10883
D405,D406	INTEGR.CIRCUIT	PC74HCT365P	5322 209 71651
D407	RAM	HM6264ALP-15	5322 209 33155
D408	INTEGR.CIRCUIT	PC74HCT356P	5322 209 71652
D409	INTEGR.CIRCUIT	PC74HCT86P	5322 209 11473
D410	INTEGR:CIRCUIT	74HCT4075N	5322 209 33187
D411	INTEGR.CIRCUIT	PC74HCT27P	5322 209 11472
D415	EEPROM	PCF8582EP/06	5322 209 33178

Pos. No.	Description				Ordering Code

TRANSISTORS / U1 VPS

V101	TRANSISTOR	BC547B			4822 130 40959

CAPACITORS / U1 VPS

C101-C125	CAP.CHIP	22NF	10%	100V	5322 126 13132
C151	CAP.ELECTROLYT.	47UF	20%	35V	4822 124 40846
C152	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C202-C213	CAP.CHIP	22NF	10%	100V	5322 126 13132
C401-C416	CAP.CHIP	22NF	10%	100V	5322 126 13132
C422	CAP.CERAMIC	2,2NF	10%	100V	5322 122 32818

RESISTORS / U1 VPS

R101	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R201	RES.METAL FILM	4K64	1%	0,4W	4822 050 14642
R401	RES.NETWORK	4.7K			5322 116 90624
R402	RES.METAL FILM	11K5	1%	0,4W	5322 117 10938
R404-R407	RES.METAL FILM	4K64	1%	0,4W	4822 050 14642

MISCELLANEOUS / U1 VPS

X114,X125	IC SOCKET	5322 255 41319
X209	IC SOCKET	5322 255 41319
X201,X202	CONNECTOR 3-P MALE	5322 267 41135
X801-X803	CONNECTOR 3-P MALE	5322 267 41135
	JUMPER FOR X201,X202,X801-X803	5322 263 60062

PAL/NTSC UNIT (U2) STANDARD

UNIT 2 COMPLETE	5322 214 91343

INTEGRATED CIRCUITS / U2

D301,D302	INTEGR.CIRCUIT	HEF4050BP	4822 209 10261
D303,D304	INTEGR.CIRCUIT	HEF4049BD	4822 209 10306
N305	INTEGR.CIRCUIT	TDA2501	4822 209 82146
N306	INTEGR.CIRCUIT	MC1458N	4822 209 81349
N307	INTEGR.CIRCUIT	SAA1044P	5322 209 81724

Pos. No.	Description				Ordering Code

TRANSISTORS , DIODES / U2

V311	TRANSISTOR	BC548B	4822 130 40937
V312,V313	TRANSISTOR	BC558B	4822 130 44197
V316	TRANSISTOR	BF450	4822 130 44237
V317,V318	TRANSISTOR	BC548B	4822 130 40937
V319,V321	TRANSISTOR	BF240	4822 130 40902
V322	TRANSISTOR	BF450	4822 130 44237
V325,V328	TRANSISTOR	BF246B	5322 130 44863
V401	DIODE	BAW62	4822 130 30613
V403	DIODE	BB212	4822 130 31129
V404	DIODE	BA482	5322 130 34955
V405-V414	DIODE	BAW62	4822 130 30613

CAPACITORS / U2

C501,V505	CAP.CERAMIC	39PF	2%	100V	4822 122 31069
C502,V506	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C503	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C507	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C509	CAP.TRIMMER	1P4-10P		250V	4822 125 50062
C510	CAP.CERAMIC	33PF	2%	100V	5322 122 32072
C511	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C512,C513	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C514	CAP.CERAMIC	120PF	2%	100V	4822 122 31348
C515	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C516,C517	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C518-C520	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C521,C523	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C522	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C524	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C528	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C529	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C530,C531	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C532	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C533,C535	CAP.CERAMIC	1,5NF	10%	500V	4822 122 31169
C536	CAP.CERAMIC	3,3NF	10%	100V	4822 122 30099
C538	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C539,C540	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C541,C542	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C543	CAP.CERAMIC	3,3NF	10%	100V	4822 122 30099
C544,C547	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C548,C555	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C551	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C556	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C557	CAP.CERAMIC	12PF	2%	100V	4822 122 31056

Pos. No.	Description				Ordering Code

RESISTORS / U2

R601	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R602	RES.METAL FILM	17K4	1%	0,4W	5322 117 10943
R603	RES.METAL FILM	93K1	1%	0,4W	5322 117 10962
R604	RES.METAL FILM	26K70	1%	0,4W	4822 050 12673
R605	RES.METAL FILM	53K60	1%	0,4W	4822 050 15363
R606	RES.METAL FILM	107K	1%	0,4W	5322 117 10936
R607	RES.METAL FILM	49K9	1%	0,4W	5322 117 11022
R608,R609	RES.METAL FILM	27K40	1%	0,4W	4822 050 12743
R610,R611	RES.METAL FILM	32K4	1%	0,4W	5322 117 10997
R612,R613	RES.METAL FILM	49K9	1%	0,4W	5322 117 11022
R614	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R615	RES.METAL FILM	48K70	1%	0,4W	4822 050 14873
R616	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R617	RES.METAL FILM	16K50	1%	0,4W	4822 050 11653
R618	RES.METAL FILM	26K1	1%	0,4W	5322 117 11021
R619,R620	RES.METAL FILM	40K20	1%	0,4W	4822 050 14023
R621,R622	RES.METAL FILM	26K1	1%	0,4W	5322 117 11021
R623	RES.METAL FILM	35K7	1%	0,4W	5322 117 10951
R624	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R625,R626	RES.METAL FILM	22K10	1%	0,4W	4822 050 12213
R627	RES.METAL FILM	105K	1%	0,4W	5322 117 11018
R628	RES.METAL FILM	31K60	1%	0,4W	4822 050 13163
R629	RES.METAL FILM	2K74	1%	0,4W	4822 050 12742
R630	RES.METAL FILM	11K8	1%	0,4W	5322 117 10939
R631	RES.METAL FILM	768R	1%	0,4W	5322 117 10961
R632	RES.METAL FILM	13K00	1%	0,4W	4822 050 11303
R633	POTM.TRIMMER	10K	CARB LIN	0,1W	4822 100 10035
R634	RES.METAL FILM	1K96	1%	0,4W	4822 050 11962
R635	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R636,R637	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R638	RES.METAL FILM	909R00	1%	0,4W	4822 050 19091
R639	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R640	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R641	RES.METAL FILM	24K9	1%	0,4W	5322 117 10991
R643	RES.METAL FILM	1K50	1%	0,4W	4822 050 11502
R644	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R645	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R646	RES.METAL FILM	1K33	1%	0,4W	4822 050 11332
R647	RES.METAL FILM	649R	1%	0,4W	5322 117 10956
R648	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R649,R650	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R651	RES.METAL FILM	487R	1%	0,4W	5322 117 11002
R652	RES.METAL FILM	147K	1%	0,4W	5322 117 10977
R653	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R654	RES.METAL FILM	12K7	1%	0,4W	5322 117 11019
R655	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R656	RES.METAL FILM	5K90	1%	0,4W	4822 050 15902
R657	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R658	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R659	RES.METAL FILM	59K0	1%	0,4W	5322 117 10955
R660	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R661	RES.METAL FILM	316R	1%	0,4W	5322 117 10948

Pos. No.	Description				Ordering Code
R662	POTM.TRIMMER	470E	CARB LIN	0,1W	4822 100 10038
R663	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R664	RES.METAL FILM	332K00	1%	0,4W	4822 050 13324
R665,R666	RES.METAL FILM	121K	1%	0,4W	5322 117 10775
R667	RES.METAL FILM	332K00	1%	0,4W	4822 050 13324
R668	RES.METAL FILM	1K78	1%	0,4W	5322 117 10983
R669	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R670	RES.METAL FILM	1K69	1%	0,4W	4822 050 11692
R671	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R672,R674	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R676	RES.NETWORK	1R0	1%	0,33W	5322 116 83063
R677	RES.METAL FILM	1K33	1%	0,4W	4822 050 11332
R678	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R681,R682	RES.METAL FILM	590K	1%	0,4W	5322 117 11004
R683,R686	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R687,R690	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R691	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R693	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R710	RES.METAL FILM	4K7	2%	0.19W	5322 111 91115
R711	RES.NETWORK	4X4K7	5%		5322 116 90131

COILS / U2

L751,L752	COIL	220UH	5322 157 52789
L753,L754	COIL	33UH	5322 157 52791
L754	COIL	10UH	5322 157 52792

CRYSTALS / U2

G781	CRYSTAL	3,579 545 MHZ	4822 242 70105
G784	CRYSTAL	4,433 619 MHZ	4822 242 70323

MISCELLANEOUS / U2

K801	REED RELAY	5322 280 20266

Pos. No.	Description				Ordering Code

PAL/NTSC UNIT (U2) ADDITIONAL PARTS FOR TXI/TNSI

PAL/NTSC UNIT TXI/TNSI (U2/IEEE) COMPLETE 5322 21491348

TRANSISTORS / U2, TXI/TNSI

V312	TRANSISTOR	PH2369			4822 130 41594
V326-V329	TRANSISTOR	BF246B			5322 130 44863
V410,V411	DIODE	BAW62			4822 130 30613
V415	DIODE	BB212			4822 130 31129
V416	DIODE	BAW62			4822 130 30613

CAPACITORS / U2, TXI/TNSI

C545,C546	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C557	CAP.TRIMMER	1P4-10P		150V	4822 125 50199
C558	CAP.CERAMIC	12PF	2%	100V	4822 122 31056

RESISTORS / U2, TXI/TNSI

R684,R685	RES.METAL FILM	100K00	1%	0,6W	4822 050 21004
R688,R689	RES.METAL FILM	1M00	1%	0,6W	4822 050 21005
R694	RES.METAL FILM	1M00	1%	0,6W	4822 050 21005
R695-R697	RES.METAL FILM	100K00	1%	0,6W	4822 050 21004

CRYSTALS / U2, TXI/TNSI

G782	CRYSTAL	3,582 056 MHZ	4822 242 81574
G783	CRYSTAL	3,575 611 MHZ	5322 242 74083

SECAM UNIT (U3) STANDARD

UNIT 3 COMPLETE 5322 214 91347

INTEGRATED CIRCUITS / U3

D301	INTEGR.CIRCUIT	HEF4050BP	4822 209 10261
D302	INTEGR.CIRCUIT	HEF4049BD	4822 209 10306
D303	INTEGR.CIRCUIT	HEF4050BP	4822 209 10261

Pos. No.	Description				Ordering Code

TRANSISTORS, DIODES / U3

V304,V307	TRANSISTOR	BF450	4822 130 44237
V305,V306	TRANSISTOR	BC548B	4822 130 40937
V308	TRANSISTOR	BF240	4822 130 40902
V309-V311	TRANSISTOR	BC548B	4822 130 40937
V314	TRANSISTOR	BF450	4822 130 44237
V401	DIODE,REFERENCE	BZX79-B6V2	4822 130 34167
V402	DIODE	BAW62	4822 130 30613

INTEGRATED CIRCUITS / U3

N312	INTEGR.CIRCUIT	TDA2507	4822 209 82403
N313	INTEGR.CIRCUIT	TDA2506	4822 209 82402

CAPACITORS / U3

C501,C503	CAP.FOIL	330NF	5%	63V	5322 121 42661
C502	CAP.SOLID ALU.	6,8UF	20%	25V	5322 124 14081
C504	CAP.SOLID ALU.	6,8UF	20%	25V	5322 124 14081
C505,C506	CAP.CERAMIC	150PF	2%	100V	4822 122 31413
C509	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C510	CAP.CERAMIC	33PF	2%	100V	5322 122 32072
C511	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C512	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C513,C515	CAP.TANTAL	0,68UF	20%	35V	5322 124 14039
C514,C516	CAP.FOIL	220NF	5%	63V	4822 121 42408
C517,C518	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C519,C520	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C521	CAP.FOIL	470NF	5%	63V	4822 121 51252
C522,C524	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C523	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C525	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C526	CAP.CERAMIC	5,6PF	0,25PF	100V	5322 122 32163
C527	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C528	CAP.FOIL	470NF	5%	63V	4822 121 51252
C529	CAP.CERAMIC	180PF	2%	100V	5322 122 31907
C530	CAP.CERAMIC	3,9NF	10%	100V	5322 122 32779
C531	CAP.FOIL	470NF	5%	63V	4822 121 51252
C532	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C533	CAP.FOIL	1NF	1%	250V	4822 121 50566
C534,C536	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C535	CAP.CERAMIC	1,5PF	0,25PF	100V	5322 122 32101
C537	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C538	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C539,C540	CAP.FOIL	470NF	5%	63V	4822 121 51252
C541	CAP.CERAMIC	470PF	2%	100V	4822 122 32062
C542	CAP.CERAMIC	1,5PF	0,25PF	100V	5322 122 32101
C543	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C544	CAP.FOIL	470NF	5%	63V	4822 121 51252

RESISTORS / U3

Pos. No.	Description				Ordering Code
R601,R602	RES.METAL FILM	33R20	1%	0,6W	4822 050 23329
R603,R604	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R605,R606	RES.METAL FILM	8K25	1%	0,6W	4822 050 28252
R607	RES.METAL FILM	56R20	1%	0,6W	4822 050 25629
R609	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R610	RES.METAL FILM	4K02	1%	0,6W	4822 050 24022
R611	POTM.TRIMMER	470E	CARB LIN	0,1W	4822 100 10023
R612,R613	RES.METAL FILM	4K22	1%	0,6W	4822 050 24222
R614	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R615,R616	RES.METAL FILM	4K87	1%	0,6W	4822 050 24872
R617	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R618	RES.METAL FILM	56R20	1%	0,6W	4822 050 25629
R619	RES.METAL FILM	5K11	1%	0,6W	4822 050 25112
R620	RES.METAL FILM	348R00	1%	0,6W	4822 050 23481
R621	RES.METAL FILM	365R00	1%	0,6W	4822 050 23651
R622	RES.METAL FILM	619R00	1%	0,6W	4822 050 26191
R623	RES.METAL FILM	1K27	1%	0,6W	4822 050 21272
R624	RES.METAL FILM	8K25	1%	0,6W	4822 050 28252
R625	RES.METAL FILM	649R00	1%	0,6W	4822 050 26491
R626	POTM.TRIMMER	1K	CARB LIN	0,1W	4822 100 10021
R627	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R628	RES.METAL FILM	56R20	1%	0,6W	4822 050 25629
R629	RES.METAL FILM	475R00	1%	0,6W	4822 050 24751
R630	RES.METAL FILM	6K49	1%	0,6W	4822 050 26492
R631	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R632	RES.METAL FILM	2K74	1%	0,6W	4822 050 22742
R633	RES.METAL FILM	56R20	1%	0,6W	4822 050 25629
R634	RES.METAL FILM	14K70	1%	0,6W	4822 050 21473
R635	RES.METAL FILM	48K70	1%	0,6W	4822 050 24873
R636	RES.METAL FILM	17K4	1%	0,4W	5322 117 10943
R637	RES.METAL FILM	24K90	1%	0,6W	4822 050 22493
R638	RES.METAL FILM	93K10	1%	0,6W	4822 050 29313
R639	RES.METAL FILM	16K50	1%	0,6W	4822 050 21653
R640	RES.METAL FILM	36K50	1%	0,6W	4822 050 23653
R641	RES.METAL FILM	121K00	1%	0,6W	4822 050 21214
R642	RES.METAL FILM	43K20	1%	0,6W	4822 050 24323
R643	RES.METAL FILM	61K90	1%	0,6W	4822 050 26193
R644	RES.METAL FILM	232K00	1%	0,6W	4822 050 22324
R645	RES.METAL FILM	41K20	1%	0,6W	4822 050 24123
R646	RES.METAL FILM	107K00	1%	0,6W	4822 050 21074
R647	RES.METAL FILM	53K60	1%	0,6W	4822 050 25363
R648	RES.METAL FILM	26K70	1%	0,6W	4822 050 22673
R649,R650	RES.METAL FILM	3K65	1%	0,6W	4822 050 23652

Pos. No.	Description				Ordering Code

COILS / U3

L751	COIL	1,5UH	4822 157 60314
L752	COIL	0,9UH	4822 157 60313
L753	COIL	33UH	5322 157 52791
L754	COIL	10UM	5322 157 52792
L755	BANDPASS FILTER	4,43MHZ	4822 154 90055
L756	BANDPASS FILTER	2,07MHZ	4822 154 90059
L757	COIL	13UH	4822 156 20861

SECAM UNIT (U3) ADDITIONAL PARTS FOR TXI/TNSI

SECAM UNIT TXI/TNSI (U3/IEEE) COMPLETE 5322 214 91357

RESISTORS / U3, TXI/TNSI

R612,R613	RES.METAL FILM	5K11	1%	0,6W	4822 050 25112
R641	RES.METAL FILM	33K20	1%	0,6W	4822 050 23323
R643	RES.METAL FILM	66K50	1%	0,6W	4822 050 26653
R645	RES.METAL FILM	22K10	1%	0,6W	4822 050 22213

TELETEXT TOP/FLOF UNIT (U4)

UNIT 4 COMPLETE 5322 214 91352

INTEGRATED CIRCUITS / U4

N101	INTEGR.CIRCUIT	ICL7621DCBA	5322 209 11929
D101	INTEGR.CIRCUIT	PC74HC00T	5322 209 71802
D102	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D103	EPROM PAL TELETEXT-FLOF		5322 209 52508
D104,D105	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D106	INTEGR.CIRCUIT	PC74HC7046AT	4822 209 30812
D108,D111	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D110	INTEGR.CIRCUIT	PC74HC20T	5322 209 31208
D112	EPROM TELETEXT-FLOF		5322 209 52507
D113	INTEGR.CIRCUIT	PC74HC151T	4822 209 12494
D114-D116	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D117	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
D118	INTEGR.CIRCUIT	PC74HC08T	5322 209 71564
D119	INTEGR.CIRCUIT	PC74HC32T	4822 209 63475
D120	INTEGR.CIRCUIT	PC74HC138T	5322 209 73178
D121	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517

Pos. No.	Description				Ordering Code

TRANSISTORS, DIODES / U4

Pos. No.	Description		Ordering Code
V101	DIODE	BB112	4822 130 32227
V102	DIODE,REFERENCE	BZV55-B8V2	4822 130 82992
V103	DIODE,REFERENCE	BZV55-B6V2	4822 130 82194
V104	DIODE,REFERENCE	BZV55-B2V4	4822 130 82993
V111	DIODE	BB112	4822 130 32227
V121	TRANSISTOR,CHIP	BC857B	5322 130 60508
V122	TRANSISTOR,CHIP	BC847B	4822 130 60511
V124,V125	TRANSISTOR,CHIP	BSV52	5322 130 44336
V126	TRANSISTOR,CHIP	BC817-25	4822 130 42804

CAPACITORS / U4

Pos. No.	Description				Ordering Code
C101-C103	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C105	CAP.CHIP	680PF	2%	63V	4822 122 31775
C106	CAP.CHIP	100NF	10%	63V	4822 122 33496
C107	CAP.CHIP	56PF	2%	63V	4822 122 31774
C108,C118	CAP.CERAMIC	100PF	2%	50V	5322 126 12152
C117	CAP.CHIP	56PF	2%	63V	4822 122 31774
C121	CAP.CERAMIC	18PF	2%	50V	5322 126 12153
C122	CAP.CHIP	2,2PF	5%	50V	4822 122 32425
C123	CAP.CERAMIC	100PF	2%	50V	5322 126 12152
C124	CAP.CHIP	15PF	2%	63V	4822 122 32504
C125,C127	CAP.CHIP	10PF	2%	63V	4822 122 31971
C126	CAP.CHIP	1,5PF	10%	50V	4822 122 31792
C128	CAP.CHIP	2,2PF	5%	50V	4822 122 32425
C151-C160	CAP.CHIP	22NF	10%	63V	4822 122 31797

RESISTORS / U4

Pos. No.	Description				Ordering Code
R101,R102	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R103	RES.METAL FILM	2K15	1%		5322 116 83693
R104	RES.METAL FILM	3M16	1%		5322 116 83696
R105	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R107	RES.METAL FILM	28K7	1%		5322 116 83694
R108	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R111,R112	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R113	RES.METAL FILM	2K15	1%		5322 116 83693
R114	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R116,R117	RES.METAL FILM	4K64	1%		5322 116 83698
R118	RES.METAL FILM	51R1	1%		5322 116 83699
R120	RES.METAL FILM	619R	1%		5322 116 83701
R121	RES.METAL FILM	13K3	1%		5322 116 83689
R122	RES.METAL FILM	750R	1%	0,25W	5322 116 81302
R123	RES.METAL FILM	31K6	1%		5322 116 83695
R124	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R125	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R126	RES.METAL FILM	1K47	1%		5322 116 83691
R127	RES.METAL FILM	1K21	1%		5322 116 83688
R128	POTM.TRIMMER	200R	20%		5322 101 11198

Pos. No.	Description				Ordering Code
R129	RES.METAL FILM	17K8	1%		5322 116 83692
R130	RES.METAL FILM	464R	1%		5322 116 83697
R131	RES.METAL FILM	1K21	1%		5322 116 83688
R132-R138	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249

CRYSTALS / U4

G781	CRYSTAL	6,937 500 MHZ	5322 242 71609
G782	CRYSTAL	6,203 125 MHZ	5322 242 71608

COILS / U4

L751	COIL	22,8UH	5322 157 52793
L752	COIL	7,1UH	5322 157 52794

MISCELLANEOUS / U4

X112	IC SOCKET (PLCC) 32-P	5322 255 41318

TELETEXT/PDC/CC UNIT (U4/PDC)

UNIT 4/PDC COMPLETE	5322 214 91355

INTEGRATED CIRCUITS / U4 PDC

N101	INTEGR.CIRCUIT	ICL7621DCBA	5322 209 11929
D101	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D103,D104	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D106	INTEGR.CIRCUIT	PC74HC7046AT	4822 209 30812
D107	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D109	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D111	INTEGR.CIRCUIT	PC74HC20T	5322 209 31208
D112	INTEGR.CIRCUIT	PC74HC08T	5322 209 71564
D113	INTEGR.CIRCUIT	PC74HC00T	5322 209 71802
D114	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D116	INTEGR.CIRCUIT	PC74HC151T	4822 209 12494
D117	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
D118	EPROM PAL2		5322 209 52522
D119	INTEGR.CIRCUIT	PC74HC32T	4822 209 63475
D121	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D122	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D123	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D201	EPROM PROGRAM PDC		5322 209 52513
D202	EPROM DATEN PDC		5322 209 52512
D203	PROCESSOR	PCF8574AT	5322 209 33172

Pos. No.	Description				Ordering Code
D204	INTEGR.CIRCUIT	74HC573D			5322 209 60424
D206	PROCESSOR	PCB80C652-12WP			5322 209 33173
D207	INTEGR.CIRCUIT	PC74HCT245T			4822 209 30207
D208	PROCESSOR	UPD43256AGU-10LL			5322 209 33182
D209	INTEGR.CIRCUIT	PC74HCT245T			4822 209 30207
D211	INTEGR.CIRCUIT	PC74HC03T			5322 209 12167
D213,D214	INTEGR.CIRCUIT	PC74HCT245T			4822 209 30207
D217	INTEGR.CIRCUIT	PC74HC86T			5322 209 71562
D301	INTEGR.CIRCUIT	PC74HC00T			5322 209 71802
D302	INTEGR.CIRCUIT	PC74HCU04T			5322 209 11517
D303-D306	INTEGR.CIRCUIT	PC74HC161T			5322 209 11518
D307	INTEGR.CIRCUIT	PC74HC00T			5322 209 71802
D402	EPROM PAL1				5322 209 52521

TRANSISTORS, DIODES / U4 PDC

V101	DIODE,REFERENCE	BZV55-B7V5	4822 130 82887
V102	TRANSISTOR,CHIP	BC857B	5322 130 60508
V103,V104	TRANSISTOR,CHIP	BSV52	5322 130 44336
V106	TRANSISTOR,CHIP	BC847B	4822 130 60511
V107	DIODE,REFERENCE	BZV55-B8V2	4822 130 82992
V108,V109	TRANSISTOR,CHIP	BSV52	5322 130 44336
V111	DIODE,REFERENCE	BZV55-B6V2	4822 130 82194
V112	TRANSISTOR,CHIP	BC817-25	4822 130 42804
V113	DIODE,REFERENCE	BZV55-B3V0	4822 130 82886
V114	TRANSISTOR,CHIP	BC857B	5322 130 60508
V116	DIODE,CHIP	BAS32L	4822 130 80446
V301-V303	DIODE	BB112	4822 130 32227

CAPACITORS / U4 PDC

C101,C102	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C103	CAP.CHIP	680PF	2%	63V	4822 122 31775
C104	CAP.CHIP	100NF	10%	63V	4822 122 33496
C106-C111	CAP.CHIP	22NF	10%	63V	4822 122 31797
C112,C116	CAP.CHIP	100PF	2%	63V	4822 122 31765
C113	CAP.CHIP	220PF	2%	63V	4822 122 31965
C114	CAP.CHIP	1500PF	2%	63V	5322 126 10328
C117	CAP.CHIP	10PF	2%	63V	4822 122 31971
C118	CAP.CHIP	1,5PF	10%	50V	4822 122 31792
C119	CAP.CHIP	15PF	2%	63V	4822 122 32504
C121	CAP.CHIP	3,3PF	5%	50V	4822 122 32079
C122-C124	CAP.CHIP	22NF	10%	63V	4822 122 31797
C126	CAP.CHIP	100PF	2%	63V	4822 122 31765
C127	CAP.CHIP	15PF	2%	63V	4822 122 32504
C128	CAP.CHIP	10PF	2%	63V	4822 122 31971
C129	CAP.CHIP	2,2PF	5%	50V	4822 122 32425
C131	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C132-C143	CAP.CHIP	22NF	10%	63V	4822 122 31797

Pos. No.	Description				Ordering Code
C144	CAP.CHIP	68PF	2%	63V	4822 122 31961
C146	CAP.CHIP	56PF	2%	63V	4822 122 31774
C147	CAP.CHIP	82PF	2%	63V	4822 122 31839
C201-C206	CAP.CHIP	22NF	10%	63V	4822 122 31797
C207,C208	CAP.CHIP	27PF	2%	63V	4822 122 31825
C209-C218	CAP.CHIP	22NF	10%	63V	4822 122 31797
C301,C304	CAP.CHIP	56PF	2%	63V	4822 122 31774
C302,C307	CAP.CHIP	100PF	2%	63V	4822 122 31765
C303,C306	CAP.CHIP	22NF	10%	63V	4822 122 31797
C308	CAP.CHIP	56PF	2%	63V	4822 122 31774
C309	CAP.CHIP	100PF	2%	63V	4822 122 31765

RESISTORS / U4 PDC

R101	RES.METAL FILM	3M16	1%		5322 116 83696
R102	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R103	RES.METAL FILM	28K7	1%		5322 116 83694
R104	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R105	RES.METAL FILM	6K81	1%	0,25W	5322 117 10921
R106,R107	RES.METAL FILM	4K64	1%		5322 116 83698
R108	RES.METAL FILM	511R	1%	0,25W	5322 117 10912
R109	POTM.TRIMMER	200R	20%	0,5W	5322 101 11303
R111	RES.METAL FILM	422R	1%	0,25W	5322 117 10906
R112,R113	RES.METAL FILM	511R	1%	0,25W	5322 117 10912
R114	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R116	RES.METAL FILM	619R	1%		5322 116 83701
R117	RES.METAL FILM	13K3	1%		5322 116 83689
R118	RES.METAL FILM	750R	1%	0,25W	5322 116 81302
R119	RES.METAL FILM	31K6	1%		5322 116 83695
R121	RES.METAL FILM	1K47	1%		5322 116 83691
R122	RES.METAL FILM	1K21	1%		5322 116 83688
R123	POTM.TRIMMER	200R	20%	0,5W	5322 101 11303
R124	RES.METAL FILM	17K8	1%		5322 116 83692
R126	RES.METAL FILM	464R	1%		5322 116 83697
R127	RES.METAL FILM	825R	1%	0,25W	5322 117 10926
R128,R131	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R132	RES.METAL FILM	17K8	1%		5322 116 83692
R133	RES.METAL FILM	11K	1%	0,25W	5322 117 10876
R201	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R202	RES.NETWORK	22K	2%	0,2W	5322 117 11017
R203,R204	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R301,R302	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R303	RES.METAL FILM	2K15	1%		5322 116 83693
R304	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R306,R308	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R309,R313	RES.METAL FILM	2K15	1%		5322 116 83693
R311,R312	RES.METAL FILM	1M	1%	0,25W	5322 116 81259

Pos. No.	Description		Ordering Code

COILS / U4 PDC

L101	COIL	120UH	5322 157 71067
L102	COIL	33UH	5322 157 71066
L103	COIL	22,8UH	5322 157 52793
L104	COIL	7,1UH	5322 157 52794

CRYSTALS / U4 PDC

G201	CRYSTAL	12,000 MHZ	4822 242 71663
G781	CRYSTAL	6,9375 MHZ	5322 242 71609
G782	CRYSTAL	6,203125 MHZ	5322 242 71608
G783	CRYSTAL	5,034964 MHZ	5322 242 71607

MISCELLANEOUS / U4 PDC

K101	RELAY		5322 280 80716
X201,X202	IC SOCKET (PLCC) 32-P		5322 255 41318

RGB & YC UNIT (U5)

UNIT 5 COMPLETE			5322 214 91351

INTEGRATED CIRCUITS / U5

D101,D102	I.C. DIGITAL	PC74HC4049P	5322 209 11341
N101	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N201	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N301	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N401	INTEGR.CIRCUIT	MC3346P	5322 209 11225

TRANSISTORS / U5

V101,V103	TRANSISTOR	BC548B	4822 130 40937
V102	DIODE,REFERENCE	BZX79-B5V6	4822 130 34173
V104	TRANSISTOR	BF247B	5322 130 62317
V201	TRANSISTOR	BC548B	4822 130 40937
V202	DIODE,REFERENCE	BZX79-B5V6	4822 130 34173
V203	TRANSISTOR	BC548B	4822 130 40937
V204	TRANSISTOR	BF247B	5322 130 62317
V301	TRANSISTOR	BC548B	4822 130 40937
V302	DIODE,REFERENCE	BZX79-B5V6	4822 130 34173
V303	TRANSISTOR	BC548B	4822 130 40937
V304	TRANSISTOR	BF247B	5322 130 62317

Pos. No.	Description				Ordering Code
V401	TRANSISTOR	BF240			4822 130 40902
V402	DIODE,REFERENCE	BZX79-B5V6			4822 130 34173
V403	TRANSISTOR	BC548B			4822 130 40937
V404	TRANSISTOR	BF247B			5322 130 62317
V406	TRANSISTOR	BF450			4822 130 44237
V511	TRANSISTOR	BF240			4822 130 40902
V512	TRANSISTOR	BF247B			5322 130 62317
V513	TRANSISTOR	BC548B			4822 130 40937
V521	TRANSISTOR	BF240			4822 130 40902
V522	TRANSISTOR	BF450			4822 130 44237
V531	TRANSISTOR	BC548B			4822 130 40937
V541,V542	TRANSISTOR	BSR52			5322 130 60255
V543	DIODE,REFERENCE	BZX79-B5V1			4822 130 34233

CAPACITORS / U5

C101	CAP.CERAMIC	39PF	2%	100V	4822 122 31069
C102	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C103,C105	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C104	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C108-C110	CAP.CERAMIC	10NF		100V	4822 122 31414
C201	CAP.CERAMIC	39PF	2%	100V	4822 122 31069
C202	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C203,C205	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C204	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C208-C210	CAP.CERAMIC	10NF		100V	4822 122 31414
C211	CAP.CERAMIC	10PF	2%	100V	4822 122 32185
C301	CAP.CERAMIC	39PF	2%	100V	4822 122 31069
C302	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C303,C305	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C304	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C308-C310	CAP.CERAMIC	10NF		100V	4822 122 31414
C404	CAP.CERAMIC	10PF	2%	100V	4822 122 32185
C405-C410	CAP.CERAMIC	10NF		100V	4822 122 31414
C501,C502	CAP.ELECTROLYT.	22UF	20%	63V	5322 124 41301
C503	CAP.ELECTROLYT.	47UF	20%	35V	4822 124 40846
C505	CAP.CERAMIC	10NF		100V	4822 122 31414
C511	CAP.CERAMIC	10NF		100V	4822 122 31414
C512,C514	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C513	CAP.CERAMIC	1PF	0,25PF	100V	4822 122 30104
C521-C523	CAP.CERAMIC	10NF		100V	4822 122 31414
C531-C533	CAP.CERAMIC	10NF		100V	4822 122 31414
C542	CAP.ELECTROLYT.	22UF	20%	63V	5322 124 41301
C555	CAP.CERAMIC	10NF		100V	4822 122 31414

Pos. No.	Description				Ordering Code

RESISTORS / U5

R101	RES.METAL FILM	147K	1%	0,4W	5322 117 10977
R102	RES.METAL FILM	11K00	1%	0,4W	4822 050 11103
R103	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R104	RES.METAL FILM	19K1	1%	0,4W	5322 117 10985
R105	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R106	RES.METAL FILM	76K8	1%	0,4W	5322 117 11008
R107	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R108	RES.METAL FILM	22K10	1%	0,4W	4822 050 12213
R109	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R110	RES.METAL FILM	487R	1%	0,4W	5322 117 11002
R111	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R112	RES.METAL FILM	953R	1%	0,4W	5322 117 10794
R113	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R114	RES.METAL FILM	6K49	1%	0,4W	5322 117 10796
R115	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R116	RES.METAL FILM	42K20	1%	0,4W	4822 050 14223
R118	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R119	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R120	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R121,R122	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R123	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R124	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R125	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R126,R127	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R128	RES.METAL FILM	511R	1%	0,4W	5322 117 10785
R201	RES.METAL FILM	147K	1%	0,4W	5322 117 10977
R202	RES.METAL FILM	11K00	1%	0,4W	4822 050 11103
R203	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R204	RES.METAL FILM	19K1	1%	0,4W	5322 117 10985
R205	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R206	RES.METAL FILM	76K8	1%	0,4W	5322 117 11008
R207	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R208	RES.METAL FILM	22K10	1%	0,4W	4822 050 12213
R209	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R210	RES.METAL FILM	487R	1%	0,4W	5322 117 11002
R211	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R212	RES.METAL FILM	953R	1%	0,4W	5322 117 10794
R213	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R214	RES.METAL FILM	6K49	1%	0,4W	5322 117 10796
R215	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R216	RES.METAL FILM	42K20	1%	0,4W	4822 050 14223
R217	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R218	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R219	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R220	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R221,R622	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R223	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R224	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R225	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R226,R627	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R228	RES.METAL FILM	511R	1%	0,4W	5322 117 10785
R229	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791

Pos. No.	Description				Ordering Code
R301	RES.METAL FILM	147K	1%	0,4W	5322 117 10977
R302	RES.METAL FILM	11K00	1%	0,4W	4822 050 11103
R303	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R304	RES.METAL FILM	19K1	1%	0,4W	5322 117 10985
R305	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R306	RES.METAL FILM	76K8	1%	0,4W	5322 117 11008
R307	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R308	RES.METAL FILM	22K10	1%	0,4W	4822 050 12213
R309	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R310	RES.METAL FILM	487R	1%	0,4W	5322 117 11002
R311	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R312	RES.METAL FILM	953R	1%	0,4W	5322 117 10794
R313	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R314	RES.METAL FILM	6K49	1%	0,4W	5322 117 10796
R315	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R316	RES.METAL FILM	42K20	1%	0,4W	4822 050 14223
R317	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R318	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R319	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R320	RES.METAL FILM	4K22	1%	0,4W	5322 117 10999
R321	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R322	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R323	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R324	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R325	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R326	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R327	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R328	RES.METAL FILM	511R	1%	0,4W	5322 117 10785
R406	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R407,R409	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R408	RES.METAL FILM	3K83	1%	0,4W	4822 050 13832
R411	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R412	RES.METAL FILM	1K47	1%	0,4W	5322 117 10976
R413	RES.METAL FILM	562R	1%	0,4W	5322 117 10789
R414	RES.METAL FILM	6K49	1%	0,4W	5322 117 10796
R415	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R416	RES.METAL FILM	42K20	1%	0,4W	4822 050 14223
R417	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R418	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R419	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R420	RES.METAL FILM	20K50	1%	0,4W	4822 050 12053
R421,R422	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R423	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R424	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R425	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R426	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R427	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R428	RES.METAL FILM	511R	1%	0,4W	5322 117 10785
R511	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R512	RES.METAL FILM	1K21	1%	0,4W	5322 117 10973
R513	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R514	RES.METAL FILM	61K9	1%	0,4W	5322 117 11007
R515	RES.METAL FILM	3K32	1%	0,4W	4822 050 13322

Pos. No.	Description				Ordering Code
R516	RES.METAL FILM	9K09	1%	0,4W	5322 117 11011
R517	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R518	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R519	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R520	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R521	POTM.TRIMMER	1K0	20%	0,5W	5322 101 10974
R522	RES.METAL FILM	2K74	1%	0,4W	4822 050 12742
R523	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R524	RES.METAL FILM	3K83	1%	0,4W	4822 050 13832
R525	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R526	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R531	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R532	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R533	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R534	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R535	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R541	RES.METAL FILM	18K7	1%	0,4W	5322 117 10984
R542	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R543	RES.METAL FILM	64R9	1%	0,4W	5322 117 10957
R544	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R545	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R546	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791

COILS / U5

L101	COIL	22,8UH	5322 157 52793
L102	COIL	7,1UH	5322 157 52794
L201	COIL	22,8UH	5322 157 52793
L202	COIL	7,1UH	5322 157 52794
L301	COIL	22,8UH	5322 157 52793
L302	COIL	7,1	5322 157 52794

MISCELLANEOUS / U5

X201	MALE HEADER 50-P (MUST BE SHORTENED)	5322 264 71047
	JUMPER FOR X201	5322 263 60062
X821-X827	PIN FOR MINI COAX CONNECTOR	5322 268 14141
X841-X847	MINI COAX CONNECTOR	5322 265 10266
	COAX CABLE 50 OHM	5322 321 21907

Pos. No.	Description		Ordering Code

MULTIBURST UNIT (U6) STANDARD

UNIT 6 COMPLETE		5322 214 61577

INTEGRATED CIRCUITS / U6

D357	INTEGR.CIRCUIT	PC74HC4017P	5322 209 73009
N358	INTEGR.CIRCUIT	LF347N	5322 209 70695
N359	INTEGR.CIRCUIT	NE521N	5322 209 14441

TRANSISTORS, DIODES / U6

V361,V364	TRANSISTOR	BC558B	4822 130 44197
V362,V363	TRANSISTOR	BC548B	4822 130 40937
V365,V366	TRANSISTOR	2N2894A	5322 130 44127
V367	TRANSISTOR,FET	BF245A	5322 130 44499
V368,V369	TRANSISTOR	BF494	4822 130 44195
V370	TRANSISTOR	PH2369	4822 130 41594
V371	TRANSISTOR	BC558B	4822 130 44197
V372,V373	TRANSISTOR	BC548B	4822 130 40937
V374	TRANSISTOR	BC558B	4822 130 44197
V447	DIODE,REFERENCE	BZX79-B6V8	4822 130 34278
V448	DIODE	BAW62	4822 130 30613
V449	DIODE,REFERENCE	BZX79-B3V0	4822 130 31881
V450	DIODE	BAW62	4822 130 30613
V451,V453	DIODE	BAW62	4822 130 30613

CAPACITORS / U6

C201,C202	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C580,C581	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C582	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C583	CAP.CERAMIC	100PF	2%	100V	4822 122 31316
C584,C585	CAP.CHIP	4,7PF	0,25PF	100V	4822 122 31822
C586,C590	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C591	CAP.CERAMIC	56PF	2%	100V	4822 122 32027
C592	CAP.CHIP	4,7PF	0,25PF	100V	4822 122 31822
C593	CAP.ELECTROLYT.	22UF	20%	35V	4822 124 40434
C594,C596	CAP.CERAMIC	22NF	80%	63V	4822 122 30103

RESISTORS / U6

R745,R746	RES.METAL FILM	4K64	1%	0,6W	4822 050 24642
R747	RES.METAL FILM	33K20	1%	0,6W	4822 050 23323
R748	RES.METAL FILM	27K40	1%	0,6W	4822 050 22743
R749	RES.METAL FILM	14K00	1%	0,6W	4822 050 21403
R750	RES.METAL FILM	12K70	1%	0,6W	4822 050 21273
R751	RES.METAL FILM	11K50	1%	0,6W	4822 050 21153
R752	RES.METAL FILM	10K70	1%	0,6W	4822 050 21073

Pos. No.	Description				Ordering Code
R753	RES.METAL FILM	9K53	1%	0,6W	4822 050 29532
R754	RES.METAL FILM	7K15	1%	0,6W	4822 050 27152
R756	RES.METAL FILM	1K21	1%	0,6W	4822 050 21212
R757	POTM.TRIMMER	470E	CARB LIN	0,1W	4822 100 10023
R758	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R759	RES.METAL FILM	2K15	1%	0,6W	4822 050 22152
R760,R761	RES.METAL FILM	1K47	1%	0,6W	4822 050 21472
R762	RES.METAL FILM	2K26	1%	0,6W	4822 050 22262
R763	RES.METAL FILM	9K53	1%	0,6W	4822 050 29532
R764	RES.METAL FILM	301R00	1%	0,6W	4822 050 23011
R765,R766	RES.METAL FILM	1K96	1%	0,6W	4822 050 21962
R767,R768	RES.METAL FILM	2K87	1%	0,6W	4822 050 22872
R769,R671	RES.METAL FILM	10K00	1%	0,6W	4822 050 21003
R770,R772	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R773	RES.METAL FILM	51R10	1%	0,6W	4822 050 25119
R774	RES.METAL FILM	4K87	1%	0,6W	4822 050 24872
R775	RES.METAL FILM	1K15	1%	0,6W	4822 050 21152
R776,R777	RES.METAL FILM	511R00	1%	0,6W	4822 050 25111
R778	RES.METAL FILM	226R00	1%	0,6W	4822 050 22261
R779	RES.METAL FILM	51R10	1%	0,6W	4822 050 25119
R780	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R781	RES.METAL FILM	9K09	1%	0,6W	4822 050 29092
R782	RES.METAL FILM	115K00	1%	0,6W	4822 050 21154
R783	RES.METAL FILM	100K00	1%	0,6W	4822 050 21004
R784	RES.METAL FILM	12K10	1%	0,6W	4822 050 21213
R785	RES.METAL FILM	68R10	1%	0,6W	4822 050 26819
R786	POTM.TRIMMER	2K2	CARB LIN	0,1W	4822 100 10027
R787	RES.METAL FILM	13K30	1%	0,6W	4822 050 21333
R788	RES.METAL FILM	5K11	1%	0,6W	4822 050 25112
R789	RES.METAL FILM	604R00	1%	0,6W	4822 050 26041
R790	RES.METAL FILM	10K50	1%	0,6W	4822 050 21053
R791	RES.METAL FILM	1K47	1%	0,6W	4822 050 21472
R792	RES.METAL FILM	178R00	1%	0,6W	4822 050 21781
R793,R795	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R794,R796	RES.METAL FILM	499R00	1%	0,6W	4822 050 24991
R797	RES.METAL FILM	178R00	1%	0,6W	4822 050 21781
R798	RES.METAL FILM	10K50	1%	0,6W	4822 050 21053
R799	RES.METAL FILM	1K47	1%	0,6W	4822 050 21472

Pos. No.	Description				Ordering Code

MULTIBURST UNIT (U6) ADDITIONAL PARTS FOR TXI/TNSI

MULTIBURST UNIT TXI/TNSI (U6/IEEE) COMPLETE 5322 214 91349

TRANSISTORS, DIODES / U6, TXI/TNSI

V454	DIODE	BAW62	4822 130 30613

RESISTORS / U6, TXI/TNSI

R800	RES.METAL FILM	105K00	1%	0,6W	4822 050 21054
R801	RES.METAL FILM	71K50	1%	0,6W	4822 050 27153

MISCELLANEOUS / U6, TXI/TNSI

X851	MALE HEADER 50-P (MUST BE SHORTENED)	5322 265 61289
	JUMPER FOR X851	5322 263 60062

NOTE: INSTRUMENTS WITH MONO SOUND DO NOT HAVE ANY UNIT 7 INSTALLED.

LF STEREO UNIT (U7/ST)

UNIT 7/ST COMPLETE 5322 214 91344

INTEGRATED CIRCUITS / U7 ST

N301,N302	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N307	INTEGR.CIRCUIT	LF347N	5322 209 70695
N318	INTEGR.CIRCUIT	TAA765A	5322 209 85515
D303	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D305	INTEGR.CIRCUIT	HEF4052BP	4822 209 10263
D306	INTEGR.CIRCUIT	HEF4053BD	5322 209 10576
D311	INTEGR.CIRCUIT	HEF4040BD	4822 209 10257
D312	INTEGR.CIRCUIT	HEF4082BD	4822 209 10271
D313	INTEGR.CIRCUIT	HEF4526BD	4822 209 10289
D314	INTEGR.CIRCUIT	HEF4018BP	5322 209 14118
N315	INTEGR.CIRCUIT	MC1458N	4822 209 81349
D316	INTEGR.CIRCUIT	HEF4046BPB	5322 209 10459
D317	INTEGR.CIRCUIT	HEF4526BD	4822 209 10289

Pos. No.	Description				Ordering Code

TRANSISTORS / U7 ST

V351-V362	TRANSISTOR	BC548B	4822 130 40937
V401-V404	DIODE	BAW62	4822 130 30613
V405,V406	DIODE,REFERENCE	BZX79-B3V0	4822 130 31881
V407	DIODE,REFERENCE	BZX79-B4V7	4822 130 34174
V408,V409	DIODE,REFERENCE	BZX79-B8V2	4822 130 34382
V410,V411	DIODE,REFERENCE	BZX79-B3V0	4822 130 31881

CAPACITORS / U7 ST

C501	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C502	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C503	CAP.CERAMIC	10NF		100V	4822 122 31414
C504	CAP.FOIL	33NF	5%	400V	5322 121 44025
C505	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C506	CAP.FOIL	33NF	5%	400V	5322 121 44025
C507	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C508,C510	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C511	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C512	CAP.ELECTROLYT.	2,2UF	20%	63V	4822 124 40244
C513	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C514	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C515	CAP.FOIL	100NF	10%	100V	5322 121 40323
C516	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C517	CAP.FOIL	100NF	10%	100V	5322 121 40323
C518	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C519,C520	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C521,C523	CAP.FOIL	1NF	1%	250V	4822 121 50566
C522	CAP.FOIL	1,5NF	1%	160V	4822 121 50432
C524	CAP.FOIL	1,5NF	1%	160V	4822 121 50432
C525-C527	CAP.ELECTROLYT.	4,7UF	20%	63V	4822 124 40246
C531-C534	CAP.FOIL	22NF	1%	63V	4822 121 50609
C535	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C536	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C537	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C538	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C539-C540	CAP.FOIL	390PF	2%	50V	5322 121 51047
C541	CAP.CERAMIC	22PF		100V	5322 122 32143
C542	CAP.CERAMIC	220PF	2%	100V	5322 122 32346
C543,C545	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C546,C547	CAP.ELECTROLYT.	100UF	20%	25V	4822 124 40207

RESISTORS / U7 ST

R601	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R602	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R603	RES.METAL FILM	20K50	1%	0,4W	4822 050 12053
R604	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R605	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R606	RES.METAL FILM	8K66	1%	0,4W	5322 117 10793
R607	RES.METAL FILM	51K10	1%	0,4W	4822 050 15113

Pos. No.	Description				Ordering Code
R608	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R609	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R610,R611	RES.METAL FILM	1K58	1%	0,4W	5322 117 10978
R612	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R613	RES.METAL FILM	7K50	1%	0,4W	4822 050 17502
R614	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R615	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R616	RES.METAL FILM	511K	1%	0,4W	5322 117 11003
R620	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R621	RES.METAL FILM	511K	1%	0,4W	5322 117 11003
R625,R627	RES.METAL FILM	1K00	1%	0,6W	4822 050 21002
R628	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R629	RES.METAL FILM	20K50	1%	0,4W	4822 050 12053
R630	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R631	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R632	RES.METAL FILM	8K66	1%	0,4W	5322 117 10793
R633	RES.METAL FILM	51K10	1%	0,4W	4822 050 15113
R634	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R635	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R636,R637	RES.METAL FILM	1K58	1%	0,4W	5322 117 10978
R638	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R639	RES.METAL FILM	7K50	1%	0,4W	4822 050 17502
R640	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R644	RES.METAL FILM	7K15	1%	0,4W	5322 117 11015
R645	RES.METAL FILM	30K1	1%	0,4W	5322 117 10996
R646,R647	RES.METAL FILM	1K96	1%	0,4W	4822 050 11962
R648	RES.METAL FILM	30K1	1%	0,4W	5322 117 10996
R650	RES.METAL FILM	4K99	1%	0,4W	4822 050 14992
R651	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R652	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R653	RES.METAL FILM	61K9	1%	0,4W	5322 117 11007
R654	RES.METAL FILM	11K50	1%	0,6W	4822 050 21153
R655	RES.METAL FILM	49K9	1%	0,4W	5322 117 11022
R656,R657	RES.METAL FILM	1K96	1%	0,4W	4822 050 11962
R658,R659	RES.METAL FILM	30K1	1%	0,4W	5322 117 10996
R660,R661	RES.METAL FILM	4K99	1%	0,4W	4822 050 14992
R671,R672	RES.METAL FILM	187K	1%	0,4W	5322 117 10776
R673	RES.METAL FILM	127K	1%	0,4W	5322 117 10941
R674,R675	RES.METAL FILM	53K60	1%	0,4W	4822 050 15363
R676	RES.METAL FILM	16K9	1%	0,4W	5322 117 10942
R677	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R678,R679	RES.METAL FILM	422K	1%	0,4W	5322 117 11001
R680	RES.METAL FILM	287K	1%	0,4W	5322 117 10994
R681,R682	RES.METAL FILM	121K	1%	0,4W	5322 117 10775
R683	RES.METAL FILM	422K	1%	0,4W	5322 117 11001
R684	RES.METAL FILM	2K37	1%	0,4W	5322 117 10988
R685	RES.METAL FILM	100K00	1%	0,4W	4822 050 11004
R686	RES.METAL FILM	9K09	1%	0,4W	5322 117 11011
R687	RES.METAL FILM	11K00	1%	0,4W	4822 050 11103
R688	RES.METAL FILM	1K05	1%	0,4W	5322 117 10972
R689	RES.METAL FILM	5K36	1%	0,4W	5322 117 10788
R690	RES.METAL FILM	40K20	1%	0,4W	4822 050 14023
R691	RES.METAL FILM	7K15	1%	0,4W	5322 117 11015
R692	RES.METAL FILM	5K36	1%	0,4W	5322 117 10788

Pos. No.	Description				Ordering Code
R693	RES.METAL FILM	619R	1%	0,4W	5322 117 11005
R694	RES.METAL FILM	78K70	1%	0,4W	4822 050 17873
R695	RES.METAL FILM	2K15	1%	0,4W	4822 050 12152
R696,R697	RES.METAL FILM	23K7	1%	0,4W	5322 117 10989
R698	RES.METAL FILM	61K9	1%	0,4W	5322 117 11007
R699	RES.METAL FILM	11K50	1%	0,6W	4822 050 21153

RF STEREO UNIT (U8/ST)

UNIT 8/ST COMPLETE		5322 214 91345

INTEGRATED CIRCUITS / U8 ST

N312	INTEGR.CIRCUIT	TL072ACP	5322 209 83579
D301	INTEGR.CIRCUIT	HEF4053BD	5322 209 10576
D302	INTEGR.CIRCUIT	HEF4046BPB	5322 209 10459
D303	INTEGR.CIRCUIT	SN74LS393N	5322 209 81649
D304	INTEGR.CIRCUIT	SN74LS11N	5322 209 81628
D305	INTEGR.CIRCUIT	SN74LS169BN	4822 209 83451
D306	INTEGR.CIRCUIT	HEF4046BPB	5322 209 10459
D310	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D313	INTEGR.CIRCUIT	HEF4071BD	4822 209 10307
D314	INTEGR.CIRCUIT	HEF4011UBP	5322 209 82504
D363,D365	INTEGR.CIRCUIT	SN74LS169BN	4822 209 83451

TRANSISTORS / U8 ST

V352,V353	TRANSISTOR	BC548B	4822 130 40937
V354-V356	TRANSISTOR	BF450	4822 130 44237
V357	TRANSISTOR	PH2369	4822 130 41594
V358-V361	TRANSISTOR	BF450	4822 130 44237
V362	TRANSISTOR	PH2369	4822 130 41594
V366,V369	TRANSISTOR	BC548B	4822 130 40937
V368	TRANSISTOR	BC548C	4822 130 44196
V370	TRANSISTOR	BF450	4822 130 44237
V401	DIODE,REFERENCE	BZX79-B4V7	4822 130 34174
V402,V403	DIODE	BAW62	4822 130 30613
V403	DIODE	BAW62	4822 130 30613
V404,V405	DIODE	BB212	4822 130 31129

CAPACITORS / U8 ST

C502	CAP.FOIL	100NF	10%	100V	5322 121 40323
C503	CAP.FOIL	470PF	1%	630V	5322 121 54078
C504	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C505-C508	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C510	CAP.CERAMIC	68PF	2%	100V	4822 122 31349

Pos. No.	Description				Ordering Code
C511	CAP.FOIL	470PF	1%	630V	5322 121 54078
C512-C517	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C519	CAP.				5322 121 42398
C520	CAP.FOIL	220NF	5%	100V	5322 121 50838
C521	CAP.FOIL	100NF	10%	100V	5322 121 40323
C522,C523	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C524	CAP.FOIL	220NF	5%	100V	5322 121 50838
C525	CAP.FOIL	1UF	10%	100V	5322 121 40197
C526-C529	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C530	CAP.CERAMIC	1,5NF	10%	500V	4822 122 31169
C531-C534	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C535	CAP.CERAMIC	1,5NF	10%	500V	4822 122 31169
C537	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C538	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C539,C540	CAP.ELECTROLYT.	100UF	20%	25V	4822 124 40207
C541	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C542	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C543	CAP.CERAMIC	6,8NF	50%	100V	4822 122 31429
C544	CAP.CERAMIC	22NF	80%	63V	4822 122 30103

RESISTORS / U8 ST

R601	RES.METAL FILM	7K15	1%	0,4W	5322 117 11015
R602	POTM.TRIMMER	2K2 CARB LIN		0,1W	4822 100 10027
R603	RES.METAL FILM	3K32	1%	0,4W	4822 050 13322
R604	RES.METAL FILM	1K62	1%	0,4W	5322 117 10979
R605	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R606	RES.METAL FILM	86K6	1%	0,4W	5322 117 11009
R609	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R610	RES.METAL FILM	31K60	1%	0,4W	4822 050 13163
R611	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R612	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R613	RES.METAL FILM	3K83	1%	0,4W	4822 050 13832
R614	POTM.TRIMMER	4K7 CARB LIN		0,1W	4822 100 10236
R615	RES.METAL FILM	5K90	1%	0,4W	4822 050 15902
R616	RES.METAL FILM	402R	1%	0,4W	5322 117 10998
R617	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R618	RES.METAL FILM	110R00	1%	0,4W	4822 050 11101
R619	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R620	RES.METAL FILM	90R90	1%	0,4W	4822 050 19099
R621	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R622	RES.METAL FILM	866R00	1%	0,4W	4822 050 18661
R623,R625	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R624	RES.METAL FILM	10M	1%	0,4W	5322 117 10766
R626	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R628	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R629	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R630	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R631,R632	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R633	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R634	RES.METAL FILM	90R90	1%	0,4W	4822 050 19099
R635	RES.METAL FILM	866R00	1%	0,4W	4822 050 18661
R636	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975

Pos. No.	Description				Ordering Code
R637	RES.METAL FILM	402R	1%	0,4W	5322 117 10998
R638	POTM.TRIMMER	4K7 CARB LIN		0,1W	4822 100 10236
R639	RES.METAL FILM	3K83	1%	0,4W	4822 050 13832
R640	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R641	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R642	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R643	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R644	RES.METAL FILM	110R00	1%	0,4W	4822 050 11101
R645	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R647	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R648	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R649	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R650	RES.METAL FILM	86K6	1%	0,4W	5322 117 11009
R651	RES.METAL FILM	10M	1%	0,4W	5322 117 10766
R652	RES.METAL FILM	1K62	1%	0,4W	5322 117 10979
R653	RES.METAL FILM	3K32	1%	0,4W	4822 050 13322
R654	POTM.TRIMMER	2K2 CARB LIN		0,1W	4822 100 10027
R655	RES.METAL FILM	1K40	1%	0,4W	4822 050 11402
R656	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R657	RES.METAL FILM	26R1	1%	0,4W	5322 117 10993
R658	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R659	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R660	RES.METAL FILM	2K15	1%	0,4W	4822 050 12152
R661,R662	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R663	RES.METAL FILM	3K01	1%	0,4W	4822 050 13012
R664	RES.METAL FILM	22K6	1%	0,4W	5322 117 10777
R665	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R666	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R667	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R668	RES.METAL FILM	1K47	1%	0,4W	5322 117 10976
R669	RES.METAL FILM	2K15	1%	0,4W	4822 050 12152
R673	RES.METAL FILM	1K10	1%	0,4W	4822 050 11102
R674	RES.METAL FILM	26R1	1%	0,4W	5322 117 10993
R675	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006

COILS / U8 ST

L751,L752	COIL	5,5UH	5322 157 52795
L753	COIL	100UH	5322 158 10243
L754,L755	COIL	220UH	5322 157 52789

Pos. No.	Description		Ordering Code

TWIN LF UNIT/1 (U7/TWIN 1); FIGURES 140 AND 141

COMPLETE SET OF TWIN RF/LF UNITS (U7/TWIN + U8/TWIN) 5322 214 91358

SINGLE UNITS ARE NOT AVAILABLE.
THE UNITS MUST BE MATCHED AND ADJUSTED TOGETHER IN THE FACTORY.

INTEGRATED CIRCUITS / U7 TWIN 1

D101	INTEGR.CIRCUIT	PCF8574T	5322 209 11578
D102	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D103	INTEGR.CIRCUIT	PC74HC21T	5322 209 60437
D104	INTEGR.CIRCUIT	PC74HC393T	5322 209 60427
D105	INTEGR.CIRCUIT	PC74HC393T	5322 209 60427
D106	EPROM NICAM DATEN		5322 209 52505
D107	INTEGR.CIRCUIT	PC74HC151T	4822 209 12494
D108,D109	INTEGR.CIRCUIT	PC74HC74T	5322 209 71589
D110	INTEGR.CIRCUIT	PC74HC174T	4822 209 12496
D111	INTEGR.CIRCUIT	PC74HC283T	4822 209 12497
D112	INTEGR.CIRCUIT	PC74HC86T	5322 209 71562
D201	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D202	INTEGR.CIRCUIT	MC145145PN	4822 209 30846
D203	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D301	INTEGR.CIRCUIT	PC74HC112T	4822 209 30544
D302	INTEGR.CIRCUIT	PC74HC4040T	4822 209 30847
D303	INTEGR.CIRCUIT	PC74HC21T	5322 209 60437
D401	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D402	EPROM NICAM FILTER		5322 209 52506
D403	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
D501	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D502	EPROM NICAM FILTER		5322 209 52506
D503	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
N201	INTEGR.CIRCUIT	TL072ACD	4822 209 30833
N301	INTEGR.CIRCUIT	LM78L05ACM	4822 209 30867
N401	INTEGR.CIRCUIT	DAC-08ED	5322 209 73513
N501	INTEGR.CIRCUIT	DAC-08ED	5322 209 73513
N601	INTEGR.CIRCUIT	LM837M	4822 209 30848

TRANSISTORS / U7 TWIN 1

V101,V103	TRANSISTOR,CHIP	BC857B	5322 130 60508
V102,V104	TRANSISTOR,CHIP	BC847B	4822 130 60511
V201	DIODE	BB112	4822 130 32227

Pos. No.	Description				Ordering Code

CAPACITORS / U7 TWIN 1

Pos. No.	Description				Ordering Code
C201	CAP.CHIP	10NF		50V	4822 122 32442
C202	CAP.CHIP	680PF	2%	63V	4822 122 31775
C203	CAP.CHIP	47PF	2%	63V	4822 122 31772
C204	CAP.CHIP	82PF	2%	63V	4822 122 31839
C301,C302	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C401	CAP.CHIP	4,7NF	10%	50V	4822 122 31784
C402	CAP.CHIP	120PF	2%	63V	4822 122 31766
C403	CAP.CHIP	39PF	2%	63V	4822 122 31972
C404	CAP.CHIP	100PF	2%	63V	4822 122 31765
C405	CAP.CHIP	4,7PF	5%	50V	4822 122 32082
C406	CAP.CHIP	47PF	2%	63V	4822 122 31772
C407	CAP.CHIP	470PF	2%	63V	4822 122 31727
C501	CAP.CHIP	4,7NF	10%	50V	4822 122 31784
C502	CAP.CHIP	120PF	2%	63V	4822 122 31766
C503	CAP.CHIP	39PF	2%	63V	4822 122 31972
C504	CAP.CHIP	100PF	2%	63V	4822 122 31765
C505	CAP.CHIP	4,7PF	5%	50V	4822 122 32082
C506	CAP.CHIP	47PF	2%	63V	4822 122 31772
C507	CAP.CHIP	470PF	2%	63V	4822 122 31727
C601-C622	CAP.CHIP	22NF	10%	63V	4822 122 31797
C623	CAP.TANTAL	10UF	20%	10V	5322 124 11217
C624-C632	CAP.CHIP	22NF	10%	63V	4822 122 31797

RESISTORS / U7 TWIN 1

Pos. No.	Description				Ordering Code
R101	RES.METAL FILM	7K5	1%	0,25W	5322 117 10923
R102	RES.METAL FILM	4K99	1%	0,25W	5322 117 10911
R103	RES.METAL FILM	3K83	1%	0,25W	5322 117 10901
R104,R105	RES.METAL FILM	75R	1%	0,25W	5322 117 10924
R106	RES.METAL FILM	2K15	1%		5322 116 83693
R107	RES.METAL FILM	7K5	1%	0,25W	5322 117 10923
R108	RES.METAL FILM	4K99	1%	0,25W	5322 117 10911
R109	RES.METAL FILM	3K83	1%	0,25W	5322 117 10901
R110,R111	RES.METAL FILM	75R	1%	0,25W	5322 117 10924
R112	RES.METAL FILM	2K15	1%		5322 116 83693
R201	RES.METAL FILM	38K3	1%	0,25W	5322 117 10902
R202	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R203	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R204	RES.METAL FILM	511K	1%	0,25W	5322 117 10915
R205,R207	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R206	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R301	RES.METAL FILM	511R	1%	0,25W	5322 117 10912
R401,R402	RES.METAL FILM	2K15	1%		5322 116 83693
R403	RES.METAL FILM	5K62	1%	0,25W	5322 117 10917

Pos. No.	Description				Ordering Code
R404	RES.METAL FILM	825R	1%	0,25W	5322 117 10926
R405	RES.METAL FILM	4K64	1%		5322 116 83698
R406	RES.METAL FILM	61K9	1%	0,25W	5322 117 10919
R501,R502	RES.METAL FILM	2K15	1%		5322 116 83693
R503	RES.METAL FILM	5K62	1%	0,25W	5322 117 10917
R504	RES.METAL FILM	825R	1%	0,25W	5322 117 10926
R505	RES.METAL FILM	4K64	1%		5322 116 83698
R506	RES.METAL FILM	61K9	1%	0,25W	5322 117 10919

CRYSTALS / U7 TWIN 1

G101	CRYSTAL SMD	5.824MHZ	5322 242 81093

COILS / U7 TWIN 1

L401	COIL	220UH	4822 157 63621
L501	COIL	220UH	4822 157 63621

MISCELLANEOUS / U7 TWIN 1

X102	MODULAR CONNECTOR 2X6-P	5322 267 51339
X821,X823	PIN FOR MINI COAX CONNECTOR	5322 268 14141
X822,X824	MINI COAX CONNECTOR	5322 265 10266

TWIN LF UNIT/2 (U7/TWIN 2); FIGURES 142 TO 144

COMPLETE SET OF TWIN RF/LF UNITS (U7/TWIN+U8/TWIN) 5322 214 91358

INTEGRATED CIRCUITS / U7 TWIN 2

D101	INTEGR.CIRCUIT	PC74HC109T	4822 209 12495
D102,D107	INTEGR.CIRCUIT	PC74HC7046AT	4822 209 30812
D103	INTEGR.CIRCUIT	PCF8574T	5322 209 11578
D105	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D108	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D109	INTEGR.CIRCUIT	PC74HC4040T	4822 209 30847
D110	INTEGR.CIRCUIT	PC74HC21T	5322 209 60437
D111	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D112	INTEGR.CIRCUIT	HEF4018BT	4822 209 30811
D113	INTEGR.CIRCUIT	PC74HC4053T	4822 209 60792
D204	INTEGR.CIRCUIT	PC74HC161T	5322 209 11518
D206	INTEGR.CIRCUIT	PC74HC7046AT	4822 209 30812
D214	INTEGR.CIRCUIT	PC74HC109T	4822 209 12495

Pos. No.	Description				Ordering Code
D401	INTEGR.CIRCUIT	PC74HC4052T/RL			5322 209 12278
D402	INTEGR.CIRCUIT	PC74HC4053T			4822 209 60792
N101-N103	INTEGR.CIRCUIT	TL072ACD			4822 209 30833
N201-N203	INTEGR.CIRCUIT	TL072ACD			4822 209 30833
N301	INTEGR.CIRCUIT	TL072ACD			4822 209 30833
N302	INTEGR.CIRCUIT	NE5532D			4822 209 30803
N401	INTEGR.CIRCUIT	TL074ACD			4822 209 30813

TRANSISTORS / U7 TWIN 2

V102,V103	TRANSISTOR,CHIP	BSR57	5322 130 60646
V104	DIODE,CHIP	BAS32L	4822 130 80446
V202,V203	TRANSISTOR,CHIP	BSR57	5322 130 60646
V204	DIODE,CHIP	BAS32L	4822 130 80446
V301,V302	TRANSISTOR,CHIP	BC847B	4822 130 60511
V401-V404	DIODE,REFERENCE	BZV55-B3V0	4822 130 82886
V405,V406	DIODE,REFERENCE	BZV55-B7V5	4822 130 82887
V407-V410	TRANSISTOR,CHIP	BC847B	4822 130 60511
V411	DIODE,REFERENCE	BZV55-B7V5	4822 130 82887
V412,V413	TRANSISTOR,CHIP	BC847B	4822 130 60511

CAPACITORS / U7 TWIN 2

C101-C103	CAP.CHIP	22NF	10%	63V	4822 122 31797
C104	CAP.CHIP	100NF	10%	63V	4822 122 33496
C105	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C106	CAP.CHIP	10NF		50V	4822 122 32442
C107,C108	CAP.CHIP	100NF	10%	63V	4822 122 33496
C109,C110	CAP.CERAMIC	5.6NF	1%	50V	5322 122 40889
C111-C113	CAP.CHIP	100NF	10%	63V	4822 122 33496
C114	CAP.CHIP	10NF		50V	4822 122 32442
C115	CAP.CHIP	100NF	10%	63V	4822 122 33496
C116,C117	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C118	CAP.CHIP	10NF		50V	4822 122 32442
C119	CAP.CHIP	22NF	10%	63V	4822 122 31797
C120-C122	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C123-C126	CAP.CHIP	100NF	10%	63V	4822 122 33496
C127	CAP.CERAMIC	680PF	10%	100V	5322 122 32052
C201,C202	CAP.CHIP	100NF	10%	63V	4822 122 33496
C203,C204	CAP.CHIP	22NF	10%	63V	4822 122 31797
C205	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C206	CAP.CHIP	10NF		50V	4822 122 32442
C207,C208	CAP.CHIP	100NF	10%	63V	4822 122 33496
C209,C210	CAP.CERAMIC	5.6NF	1%	50V	5322 122 40889
C211,C213	CAP.CHIP	100NF	10%	63V	4822 122 33496

Pos. No.	Description				Ordering Code
C214	CAP.CHIP	10NF		50V	4822 122 32442
C215	CAP.CHIP	100NF	10%	63V	4822 122 33496
C216,C217	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C218	CAP.CHIP	10NF		50V	4822 122 32442
C219,C221	CAP.CHIP	100NF	10%	63V	4822 122 33496
C220	CAP.CHIP	22NF	10%	63V	4822 122 31797
C222	CAP.CERAMIC	680PF	10%	100V	5322 122 32052
C301	CAP.CHIP	22NF	10%	63V	4822 122 31797
C302	CAP.CHIP	10NF		50V	4822 122 32442
C303	CAP.CHIP	100NF	10%	63V	4822 122 33496
C304-C309	CAP.CHIP	22NF	10%	63V	4822 122 31797
C310-C313	CAP.CERAMIC	5.6NF	1%	50V	5322 122 40889
C314	CAP.CHIP	100NF	10%	63V	4822 122 33496
C315,C316	CAP.TANTAL	68UF	20%	6,3V	5322 124 11253
C317	CAP.CHIP	220PF	2%	63V	4822 122 31965
C318,C319	CAP.CERAMIC	390PF	1%	50V	5322 122 40888
C320	CAP.CHIP	100NF	10%	63V	4822 122 33496
C321	CAP.TANTAL	10UF	20%	10V	5322 124 11217
C322,C323	CAP.CHIP	100NF	10%	63V	4822 122 33496
C324	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C325	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C401,C402	CAP.TANTAL	10UF	20%	10V	5322 124 11217
C403-C407	CAP.CHIP	22NF	10%	63V	4822 122 31797
C408,C410	CAP.CERAMIC	1NF	1%	50V	5322 122 40894
C409,C411	CAP.CERAMIC	1.5NF	1%	50V	5322 122 40891
C412	CAP.CHIP	22NF	10%	63V	4822 122 31797
C413,C413	CAP.ELECTROLYT.	10UF	20%	63V	5322 124 21749

RESISTORS / U7 TWIN 2

R101	RES.METAL FILM	26K1	1%	0,25W	5322 117 10892
R102	RES.METAL FILM	38K3	1%	0,25W	5322 117 10902
R103	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R104	RES.METAL FILM	9K09	1%	0,25W	5322 117 10931
R105	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R106-R108	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R109	RES.METAL FILM	3K48	1%	0,25W	5322 117 10897
R110	RES.METAL FILM	110K	1%	0,25W	5322 117 10877
R111	RES.METAL FILM	316R	1%	0,25W	5322 117 10895
R112	RES.METAL FILM	82R	1%	0,25W	5322 116 81305
R113,R114	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R116	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R117	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R118,R119	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R120	RES.METAL FILM	40K2	1%	0,25W	5322 117 10905
R121	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R122	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R124	RES.METAL FILM	1K21	1%	0,25W	5322 116 83688
R125	RES.METAL FILM	23K7	1%	0,25W	5322 117 10891
R126	RES.METAL FILM	4K99	1%	0,25W	5322 117 10911
R127	RES.METAL FILM	1R00	1%	0,6W	4822 050 21008

Pos. No.	Description				Ordering Code
R201	RES.METAL FILM	8K25	1%	0,25W	5322 117 10927
R202	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R203	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R204	RES.METAL FILM	9K09	1%	0,25W	5322 117 10931
R205	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R206-R208	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R209	RES.METAL FILM	3K48	1%	0,25W	5322 117 10897
R210	RES.METAL FILM	178K	1%	0,25W	5322 117 10886
R211	RES.METAL FILM	316R	1%	0,25W	5322 117 10895
R212	RES.METAL FILM	82R	1%	0,25W	5322 116 81305
R213,R214	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R216	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R217	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R218,R219	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R220	RES.METAL FILM	40K2	1%	0,25W	5322 117 10905
R221	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R222	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R224	RES.METAL FILM	1K21	1%	0,25W	5322 116 83688
R225	RES.METAL FILM	23K7	1%	0,25W	5322 117 10891
R226	RES.METAL FILM	4K99	1%	0,25W	5322 117 10911
R301	RES.METAL FILM	9K09	1%	0,25W	5322 117 10931
R302	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R303	RES.METAL FILM	11K	1%	0,25W	5322 117 10876
R304,R305	RES.METAL FILM	562K	1%	0,25W	5322 117 10918
R306	RES.METAL FILM	383K	1%	0,25W	5322 117 10903
R307	RES.METAL FILM	110K	1%	0,25W	5322 117 10877
R308	RES.METAL FILM	1M21	1%	0,25W	5322 117 10879
R309	RES.METAL FILM	1M21	1%	0,25W	5322 117 10879
R310	RES.METAL FILM	825K	1%	0,25W	5322 117 10928
R311	RES.METAL FILM	348K	1%	0,25W	5322 117 10899
R312	RES.METAL FILM	162K	1%	0,25W	5322 117 10884
R313	RES.METAL FILM	348K	1%	0,25W	5322 117 10899
R314	RES.METAL FILM	162K	1%	0,25W	5322 117 10884
R315	RES.METAL FILM	348K	1%	0,25W	5322 117 10899
R316,R317	RES.METAL FILM	2K15	1%	0,25W	5322 116 83693
R318	RES.METAL FILM	6K81	1%	0,25W	5322 117 10921
R319	RES.METAL FILM	909R	1%	0,25W	5322 117 10929
R320,R321	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R322	RES.METAL FILM	40K2	1%	0,25W	5322 117 10905
R323	RES.METAL FILM	715R	1%	0,25W	5322 117 10922
R324	RES.METAL FILM	78K7	1%	0,25W	5322 117 10925
R325	RES.METAL FILM	61K9	1%	0,25W	5322 117 10919
R401,R403	RES.METAL FILM	511R	1%	0,25W	5322 117 10912
R405	RES.METAL FILM	511K	1%	0,25W	5322 117 10915
R406	RES.METAL FILM	2K37	1%	0,25W	5322 117 10889
R407	RES.METAL FILM	511K	1%	0,25W	5322 117 10915
R408	RES.METAL FILM	2K37	1%	0,25W	5322 117 10889
R409	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R410,R411	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R412,R413	RES.METAL FILM	31K6	1%	0,25W	5322 116 83695
R414	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R415,R416	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R417,R418	RES.METAL FILM	31K6	1%	0,25W	5322 116 83695

Pos. No.	Description				Ordering Code
R419,R420	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R421-R423	RES.METAL FILM	4K99	1%	0,25W	5322 117 10911
R424	RES.METAL FILM	61K9	1%	0,25W	5322 117 10919
R425,R426	RES.METAL FILM	11K	1%	0,25W	5322 117 10876
R427,R428	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R429	RES.METAL FILM	6K81	1%	0,25W	5322 117 10921
R430,R431	RES.METAL FILM	100K	1%	0,25W	5322 116 81258

COILS / U7 TWIN 2

L102,L103	COIL	220UH	5322 157 53012

MISCELLANEOUS / U7 TWIN 2

X102	CONNECTOR 2X50-P (MUST BE SHORTENED)	5322 264 71048

TWIN RF UNIT (U8/TWIN)

COMPLETE SET OF TWIN RF/LF UNITS (U7 TWIN+U8/TWIN) 5322 214 91358

INTEGRATED CIRCUITS / U8 TWIN

D101	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D102	PROCESSOR	MC145145DW2	5322 209 33186
D103	INTEGR.CIRCUIT	PC74HC4053T	4822 209 60792
D104	INTEGR.CIRCUIT	PC74HCU04T	5322 209 11517
D201	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D202	PROCESSOR	MC145145DW2	5322 209 33186
D203	INTEGR.CIRCUIT	PC74HC4053T	4822 209 60792
D301	INTEGR.CIRCUIT	PC74HC4094T	5322 209 12171
D302	PROCESSOR	MC145145DW2	5322 209 33186
D303	INTEGR.CIRCUIT	PCF8574T	5322 209 11578
N101	INTEGR.CIRCUIT	TL072ACD	4822 209 30833
N202	INTEGR.CIRCUIT	MC1496D	4822 209 63447
N203	INTEGR.CIRCUIT	MC1496D	4822 209 63447
N301	INTEGR.CIRCUIT	TL072ACD	4822 209 30833

TRANSISTORS, DIODES / U8 TWIN

Pos. No.	Description		Ordering Code
V101-V104	TRANSISTOR,CHIP	BC847B	4822 130 60511
V105	DIODE,CHIP	BAS32L	4822 130 80446
V106,V107	TRANSISTOR,CHIP	BF550	4822 130 42131
V108	DIODE	BB212	4822 130 31129
V110-V112	TRANSISTOR,CHIP	BF550	4822 130 42131
V113	DIODE,REFERENCE	BZV55-B7V5	4822 130 82887
V201,V202	TRANSISTOR,CHIP	BC847B	4822 130 60511
V204,V206	TRANSISTOR,CHIP	BF550	4822 130 42131
V205	DIODE,CHIP	BAS32L	4822 130 80446
V208	DIODE	BB212	4822 130 31129
V209	TRANSISTOR,CHIP	BF550	4822 130 42131
V210,V211	TRANSISTOR,CHIP	BF840	4822 130 60887
V212	TRANSISTOR,CHIP	BF550	4822 130 42131
V213	TRANSISTOR,CHIP	BC847B	4822 130 60511
V214	TRANSISTOR,CHIP	BF840	4822 130 60887
V215	DIODE,CHIP	BAS32L	4822 130 80446
V216,V217	TRANSISTOR,CHIP	BF550	4822 130 42131
V302	DIODE	BB510	5322 130 82888

CAPACITORS / U8 TWIN

C101	CAP.CHIP	6,8NF	10%	63V	4822 122 32597
C102	CAP.TANTAL	68UF	20%	6,3V	5322 124 11253
C103	CAP.CERAMIC	220NF	10%	50V	5322 122 40893
C104	CAP.CHIP	100NF	10%	63V	4822 122 33496
C105	CAP.FOIL	1UF	10%	63V	4822 121 51319
C106	CAP.CHIP	470PF	2%	63V	4822 122 31727
C107	CAP.CHIP	47PF	2%	63V	4822 122 31772
C108	CAP.CHIP	22NF	10%	63V	4822 122 31797
C109	CAP.CHIP	22NF	10%	63V	4822 122 31797
C110	CAP.CHIP	22NF	10%	63V	4822 122 31797
C111	CAP.CHIP	22NF	10%	63V	4822 122 31797
C112	CAP.CHIP	22NF	10%	63V	4822 122 31797
C113	CAP.CHIP	1500PF	2%	63V	5322 126 10328
C114	CAP.TANTAL	10UF	20%	10V	5322 124 11217
C115	CAP.CHIP	22NF	10%	63V	4822 122 31797
C116	CAP.CHIP	22NF	10%	63V	4822 122 31797
C117,C118	CAP.CHIP	100NF	10%	63V	4822 122 33496
C119	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C121	CAP.CHIP	22NF	10%	63V	4822 122 31797
C201	CAP.CHIP	100NF	10%	63V	4822 122 33496
C202,C203	CAP.CHIP	22NF	10%	63V	4822 122 31797
C204	CAP.CERAMIC	220NF	10%	50V	5322 122 40893
C206	CAP.FOIL	1UF	10%	63V	4822 121 51319
C207,C208	CAP.CHIP	22NF	10%	63V	4822 122 31797
C209	CAP.CHIP	390PF	2%	63V	4822 122 31771
C211	CAP.CHIP	39PF	2%	63V	4822 122 31972
C212-C214	CAP.CHIP	22NF	10%	63V	4822 122 31797

Pos. No.	Description				Ordering Code
C215,C216	CAP.CHIP	100NF	10%	63V	4822 122 33496
C217	CAP.CHIP	22NF	10%	63V	4822 122 31797
C218	CAP.CHIP	100NF	10%	63V	4822 122 33496
C219	CAP.CHIP	33PF	2%	63V	4822 126 10324
C221,C223	CAP.FOIL	0.5-15PF			5322 101 11165
C222	CAP.CHIP	15PF	2%	63V	4822 122 32504
C226	CAP.CHIP	22NF	10%	63V	4822 122 31797
C227,C228	CAP.CHIP	100NF	10%	63V	4822 122 33496
C229,C231	CAP.CHIP	22NF	10%	63V	4822 122 31797
C237,C238	CAP.CHIP	100NF	10%	63V	4822 122 33496
C239	CAP.CHIP	22NF	10%	63V	4822 122 31797
C242	CAP.CHIP	100NF	10%	63V	4822 122 33496
C243	CAP.CERAMIC	470NF	10%	50V	5322 122 40892
C244	CAP.CHIP	100NF	10%	63V	4822 122 33496
C301-C301	CAP.ELECTROLYT.	100UF	20%	16V	4822 124 21912
C304	CAP.CHIP	100NF	10%	63V	4822 122 33496
C305	CAP.CHIP	680PF	2%	63V	4822 122 31775
C306	CAP.CHIP	100PF	2%	63V	4822 122 31765
C307	CAP.CHIP	68PF	2%	63V	4822 122 31961
C601,C602	CAP.CHIP	100NF	10%	63V	4822 122 33496
C603	CAP.CHIP	22NF	10%	63V	4822 122 31797
C612	CAP.CHIP	22NF	10%	63V	4822 122 31797
C613-C615	CAP.CHIP	100NF	10%	63V	4822 122 33496
C641	CAP.CHIP	22NF	10%	63V	4822 122 31797

RESISTORS / U8 TWIN

R102	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R103	POTM.TRIMMER	2K	20%	0,25W	5322 101 11307
R104	RES.METAL FILM	1K62	1%	0,25W	5322 117 10883
R105	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R106	RES.METAL FILM	1K47	1%		5322 116 83691
R107	RES.METAL FILM	2K15	1%		5322 116 83693
R108	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R109,R113	RES.METAL FILM	14K7	1%	0,25W	5322 117 10882
R110	RES.METAL FILM	28K7	1%		5322 116 83694
R114	RES.METAL FILM	17K8	1%		5322 116 83692
R115	RES.METAL FILM	42K2	1%	0,25W	5322 117 10908
R116,R117	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R118	RES.METAL FILM	2K15	1%		5322 116 83693
R119	RES.METAL FILM	3K83	1%	0,25W	5322 117 10901
R120	RES.METAL FILM	422R	1%	0,25W	5322 117 10906
R121	POTM.TRIMMER	5K0	20%	0,5W	5322 101 10975
R122	RES.METAL FILM	5K62	1%	0,25W	5322 117 10917
R123	RES.METAL FILM	110R	1%	0,25W	5322 117 10874
R124	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907
R125	RES.METAL FILM	13K3	1%		5322 116 83689
R126	RES.METAL FILM	2K37	1%	0,25W	5322 117 10889
R127	RES.METAL FILM	9R09	1%	0,25W	5322 117 10932
R128	RES.METAL FILM	825R	1%	0,25W	5322 117 10926
R129	RES.METAL FILM	619R	1%		5322 116 83701

Pos. No.	Description				Ordering Code
R130	RES.METAL FILM	2K15	1%		5322 116 83693
R131	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R132	RES.METAL FILM	261R	1%	0,25W	5322 117 10893
R133	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907
R134	RES.METAL FILM	619R	1%		5322 116 83701
R135	RES.METAL FILM	82R	1%	0,25W	5322 116 81305
R136	RES.METAL FILM	2K87	1%	0,25W	5322 117 10894
R137	RES.METAL FILM	261R	1%	0,25W	5322 117 10893
R138	RES.METAL FILM	1K10	1%	0,25W	5322 117 10875
R139	RES.METAL FILM	51R1	1%		5322 116 83699
R140	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R141	RES.METAL FILM	6K81	1%	0,25W	5322 117 10921
R142	RES.METAL FILM	2K37	1%	0,25W	5322 117 10889
R201	POTM.TRIMMER	POTM 2K	20%	0,25W	5322 101 11307
R202	RES.METAL FILM	1K62	1%	0,25W	5322 117 10883
R203	RES.METAL FILM	46K40	1%	0,25W	5322 117 10909
R204	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R205	RES.METAL FILM	2K87	1%	0,25W	5322 117 10894
R206,R207	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R208	RES.METAL FILM	2K15	1%		5322 116 83693
R209,R212	RES.METAL FILM	14K7	1%	0,25W	5322 117 10882
R211	RES.METAL FILM	51K1	1%	0,25W	5322 117 10914
R213	RES.METAL FILM	42K2	1%	0,25W	5322 117 10908
R217	RES.METAL FILM	422R	1%	0,25W	5322 117 10906
R218	RES.METAL FILM	3K83	1%	0,25W	5322 117 10901
R219	POTM.TRIMMER	5K0	20%	0,5W	5322 101 10975
R221	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R222	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907
R223	RES.METAL FILM	110R	1%	0,25W	5322 117 10874
R224	RES.METAL FILM	13K3	1%		5322 116 83689
R225	RES.METAL FILM	82R	1%	0,25W	5322 116 81305
R226	RES.METAL FILM	2K37	1%	0,25W	5322 117 10889
R227	RES.METAL FILM	9R09	1%	0,25W	5322 117 10932
R228	RES.METAL FILM	825R	1%	0,25W	5322 117 10926
R229	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R231,R232	RES.METAL FILM	51R1	1%		5322 116 83699
R233	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R234	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R236	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R237	RES.METAL FILM	51K1	1%	0,25W	5322 117 10914
R238	RES.METAL FILM	3K16	1%	0,25W	5322 117 10896
R239,R241	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R242,R246	RES.METAL FILM	750R	1%	0,25W	5322 116 81302
R243	RES.METAL FILM	12K1	1%	0,25W	5322 117 10878
R244	RES.METAL FILM	100K	1%	0,25W	5322 116 81258
R247	RES.METAL FILM	1K10	1%	0,25W	5322 117 10875
R248	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907
R249	RES.METAL FILM	562R	1%	0,25W	5322 117 10916
R251	RES.METAL FILM	1K78	1%	0,25W	5322 117 10885
R252	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R253	POTM.TRIMMER	10K	±20%	0,25W	5322 101 11306
R254	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R256	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907

Pos. No.	Description				Ordering Code
R257	RES.METAL FILM	51R1	1%		5322 116 83699
R258,R259	RES.METAL FILM	51R1	1%		5322 116 83699
R261	RES.METAL FILM	1K62	1%	0,25W	5322 117 10883
R262	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R272	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R273	POTM.TRIMMER	10K	±20%	0,25W	5322 101 11306
R274	RES.METAL FILM	1K96	1%	0,25W	5322 117 10887
R276	RES.METAL FILM	4K22	1%	0,25W	5322 117 10907
R277,R278	RES.METAL FILM	51R1	1%		5322 116 83699
R279	RES.METAL FILM	1R0	1%	0,25W	5322 117 10873
R281	RES.METAL FILM	1K33	1%	0,25W	5322 117 10881
R282	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R283	POTM.TRIMMER	500R	±20%	0,25W	5322 101 11305
R284,R286	RES.METAL FILM	9R09	1%	0,25W	5322 117 10932
R287	RES.METAL FILM	261R	1%	0,25W	5322 117 10893
R288	RES.METAL FILM	1K10	1%	0,25W	5322 117 10875
R289	RES.METAL FILM	1K0	1%	0,25W	5322 116 81256
R292,R293	RES.METAL FILM	215R	1%	0,25W	5322 117 10888
R301-R308	RES.METAL FILM	5K11	1%	0,25W	5322 117 10913
R310,R311	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R311	RES.METAL FILM	10K	0,1%	0,25W	5322 116 81249
R312	RES.METAL FILM	34K8	1%	0,25W	5322 117 10898
R313	RES.METAL FILM	3M83	1%	0,25W	5322 117 10904
R314	RES.METAL FILM	1K47	1%		5322 116 83691
R316	RES.METAL FILM	1M	1%	0,25W	5322 116 81259
R321-R323	RES.METAL FILM	1R	1%	0,25W	5322 117 11013

CRYSTALS / U8 TWIN

G301	CRYSTAL	11,34 MHZ	5322 242 81581

COILS / U8 TWIN

L101	COIL	220UH	4822 157 63621
L102	COIL	5,5UH	5322 157 52795
L103	SMD COIL	100UH	5322 157 71046
L201	COIL	220UH	4822 157 63621
L202	COIL	5,5UH	5322 157 52795

MISCELLANEOUS / U8 TWIN

T203	TRANSFORMER	5322 148 81376

Pos. No.	Description		Ordering Code

MONO SOUND UNIT (U8)

UNIT 8 COMPLETE		5322 214 91346

INTEGRATED CIRCUITS / U8

N301	INTEGR.CIRCUIT	MC3346P	5322 209 11225
N303	INTEGR.CIRCUIT	LF353N	5322 209 81395
N304	INTEGR.CIRCUIT	TL071CP-00	4822 209 81315
D302	INTEGR.CIRCUIT	HEF4053BD	5322 209 10576
D305	INTEGR.CIRCUIT	HEF4046BPB	5322 209 10459
D306	INTEGR.CIRCUIT	SN74LS393N	5322 209 81649
D307	INTEGR.CIRCUIT	SN74LS169BN	4822 209 83451
D308	INTEGR.CIRCUIT	SN74LS11N	5322 209 81628
D309	INTEGR.CIRCUIT	HEF4094BD	5322 209 10421
D310	INTEGR.CIRCUIT	HEF4001BD	4822 209 10246
D311	INTEGR.CIRCUIT	HEF4071BD	4822 209 10307
D312	INTEGR.CIRCUIT	HEF4011UBP	5322 209 82504

TRANSISTORS, DIODES / U8

V351	TRANSISTOR	BC548C	4822 130 44196
V352	TRANSISTOR	BC548B	4822 130 40937
V353	TRANSISTOR	BC558B	4822 130 44197
V354-V357	TRANSISTOR	BC548B	4822 130 40937
V358-V361	TRANSISTOR	BF450	4822 130 44237
V362	TRANSISTOR	PH2369	4822 130 41594
V363	TRANSISTOR	BC548C	4822 130 44196
V364	TRANSISTOR	BF450	4822 130 44237
V401,V402	DIODE	BAW62	4822 130 30613
V403,V404	DIODE,REFERENCE	BZX79-B8V2	4822 130 34382
V406	DIODE,REFERENCE	BZX79-B4V7	4822 130 34174
V407	DIODE	BAW62	4822 130 30613
V408	DIODE	BB212	4822 130 31129
V409	DIODE,REFERENCE	BZX79-B5V1	4822 130 34233

CAPACITORS / U8

C501	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C502,C503	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C504	CAP.ELECTROLYT.	100UF	20%	10V	4822 124 41584
C505	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C506	CAP.ELECTROLYT.	10UF	20%	50V	4822 124 40435
C507,C508	CAP.FOIL	100NF	10%	100V	5322 121 40323
C509	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 40242
C510	CAP.FOIL	1,5NF	1%	160V	4822 121 50432
C511	CAP.FOIL	1NF	1%	250V	4822 121 50566
C512	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C513-C515	CAP.CERAMIC	22NF	80%	63V	4822 122 30103

Pos. No.	Description				Ordering Code
C516	CAP.FOIL	470PF	1%	630V	5322 121 54078
C517	CAP.CERAMIC	68PF	2%	100V	4822 122 31349
C518-C524	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C526	CAP.FOIL	100NF	10%	100V	5322 121 40323
C527	CAP.FOIL	220NF	10%	100V	4822 121 41673
C528	CAP.FOIL	1UF	10%	100V	5322 121 40197
C529	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C530	CAP.CERAMIC	4,7NF	80%	63V	4822 122 31125
C531-C531	CAP.ELECTROLYT.	100UF	20%	25V	4822 124 40207
C534	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C535,C536	CAP.ELECTROLYT.	47UF	20%	10V	4822 124 40177
C537	CAP.CERAMIC	1,5NF	10%	500V	4822 122 31169
C538,C540	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C539	CAP.CERAMIC	6,8NF	50%	100V	4822 122 31429

RESISTORS / U8

R601	RES.METAL FILM	40K20	1%	0,4W	4822 050 14023
R602	RES.METAL FILM	511K	1%	0,4W	5322 117 11003
R603	RES.METAL FILM	7K87	1%	0,4W	5322 117 10791
R604	RES.METAL FILM	46K40	1%	0,4W	4822 050 14643
R605	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R606	RES.METAL FILM	82K50	1%	0,4W	4822 050 18253
R607	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R608	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R609	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R610	RES.METAL FILM	20K50	1%	0,4W	4822 050 12053
R611	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R612	RES.METAL FILM	8K66	1%	0,4W	5322 117 10793
R613	RES.METAL FILM	3K16	1%	0,4W	4822 050 13162
R614	RES.METAL FILM	14K70	1%	0,4W	4822 050 11473
R615,R616	RES.METAL FILM	1K58	1%	0,4W	5322 117 10978
R617	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R618	RES.METAL FILM	51K10	1%	0,4W	4822 050 15113
R619	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R620	RES.METAL FILM	7K50	1%	0,4W	4822 050 17502
R621	RES.METAL FILM	23K7	1%	0,4W	5322 117 10989
R622	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R623	RES.METAL FILM	1K96	1%	0,4W	4822 050 11962
R624,R625	RES.METAL FILM	30K1	1%	0,4W	5322 117 10996
R626	RES.METAL FILM	49K9	1%	0,4W	5322 117 11022
R627	RES.METAL FILM	1K96	1%	0,4W	4822 050 11962
R628	RES.METAL FILM	7K15	1%	0,4W	5322 117 11015
R629	POTM.TRIMMER	2K2 CARB LIN		0,1W	4822 100 10027
R630	RES.METAL FILM	3K32	1%	0,4W	4822 050 13322
R631	RES.METAL FILM	1K62	1%	0,4W	5322 117 10979
R632	RES.METAL FILM	2K05	1%	0,4W	4822 050 12052
R633	RES.HI-TENSION	10M00	5%	0,25W	4822 053 20106
R634	RES.METAL FILM	86K6	1%	0,4W	5322 117 11009
R635,R636	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R638	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R639	RES.METAL FILM	5K36	1%	0,4W	5322 117 10788
R640,R642	RES.METAL FILM	402R	1%	0,4W	5322 117 10998

Pos. No.	Description				Ordering Code
R643	RES.METAL FILM	6K19	1%	0,4W	5322 117 11006
R644	POTM.TRIMMER	4K7 CARB LIN		0,1W	4822 100 10236
R645	RES.METAL FILM	3K83	1%	0,4W	4822 050 13832
R648,R650	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R649	RES.METAL FILM	44K20	1%	0,4W	4822 050 14423
R651	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R652	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R653	RES.METAL FILM	110R00	1%	0,4W	4822 050 11101
R654	RES.METAL FILM	14K0	1%	0,4W	5322 117 10975
R655,R656	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R657	RES.METAL FILM	2K26	1%	0,4W	5322 117 10987
R658	RES.METAL FILM	90R90	1%	0,4W	4822 050 19099
R659	RES.METAL FILM	1K40	1%	0,4W	4822 050 11402
R660	RES.METAL FILM	866R00	1%	0,4W	4822 050 18661
R661	RES.METAL FILM	26R1	1%	0,4W	5322 117 10993
R662	RES.METAL FILM	4K02	1%	0,4W	5322 117 10783
R664	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R665	RES.METAL FILM	3K01	1%	0,4W	4822 050 13012
R666	RES.METAL FILM	2K15	1%	0,4W	4822 050 12152
R667	RES.METAL FILM	5K11	1%	0,4W	4822 050 15112
R668	RES.METAL FILM	1K33	1%	0,4W	4822 050 11332
R669	RES.METAL FILM	2K87	1%	0,4W	5322 117 10947
R670	RES.METAL FILM	12K10	1%	0,4W	4822 050 11213
R671	RES.METAL FILM	619R	1%	0,4W	5322 117 11005
R672	RES.METAL FILM	1K10	1%	0,4W	4822 050 11102
R673	RES.METAL FILM	26R1	1%	0,4W	5322 117 10993

COILS / U8

L751	COIL	5,5UH	5322 157 52795
L752	COIL	100UH	5322 158 10243

RF UNIT (U10)

UNIT 10 COMPLETE	5322 214 91337

TRANSISTORS, DIODES / U10

V301-V306	TRANSISTOR	BF979	4822 130 41613
V307	TRANSISTOR	BC558B	4822 130 44197
V401-V402	DIODE	BB130	5322 130 32281
V403-V406	DIODE	BB909A	5322 130 32162
V407-V408	DIODE	BB405B	5322 130 34953
V409-V410	DIODE	BB909A	5322 130 32162
V411-V416	DIODE	BA482	5322 130 34955
V417-V418	DIODE	BB909A	5322 130 32162
V421-V422	DIODE	BA482	5322 130 34955
V451-V462	DIODE	BA482	5322 130 34955
V463-V464	DIODE	BB130	5322 130 32281
V465	DIODE	BA482	5322 130 34955

Pos. No.	Description				Ordering Code

INTEGRATED CIRCUITS / U10

N351	INTEGR.CIRCUIT	OM2050			5322 209 81008
D352	INTEGR.CIRCUIT	SP4541			5322 209 82348
N353	INTEGR.CIRCUIT	OM2061			5322 209 33185
N354	INTEGR.CIRCUIT	CB324M1B			5322 209 61906

CAPACITORS / U10

C501,C506	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C503	CAP.CERAMIC	3,3NF	10%	100V	4822 122 30099
C504-C505	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C507	CAP.CERAMIC	12PF	2%	100V	4822 122 31056
C508	CAP.CERAMIC	82PF	2%	100V	5322 122 32344
C509,C510	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C511	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C513	CAP.CERAMIC	82PF	2%	100V	5322 122 32344
C514,C515	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C517	CAP.CHIP	4,7PF	0,25PF	100V	4822 122 31822
C518	CAP.CERAMIC	0,68PF	0,25PF	500V	4822 122 31213
C519,C520	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C521	CAP.CERAMIC	0,68PF	0,25PF	63V	5322 122 40411
C522	CAP.CHIP	100PF	2%	63V	4822 122 31765
C523,C525	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C524	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C526	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C527	CAP.CHIP	4,7PF	0,25PF	100V	4822 122 31822
C528	CAP.CHIP	3,3PF	0,25PF	100V	4822 122 31821
C529,C530	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C531-C536	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C537	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C538,C542	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C539	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C540,C544	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C545,C546	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C547	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C548	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C550	CAP.CERAMIC	10NF		100V	4822 122 31414
C551	CAP.FOIL	1NF	1%	250V	4822 121 50566
C552	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C553	CAP.CERAMIC	220NF	10%	50V	5322 122 40893
C554	CAP.CERAMIC	47PF	2%	100V	4822 122 31072
C557,C558	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C559	CAP.CHIP	4,7PF	0,25PF	100V	4822 122 31822
C572,C573	CAP.CERAMIC	8,2PF	0,25PF	100V	4822 122 31052
C574	CAP.CERAMIC	0,68PF	0,25PF	500V	4822 122 31213
C575	CAP.CERAMIC	10PF	2%	100V	4822 122 32185
C576,C577	CAP.CERAMIC	22PF		100V	5322 122 32143
C578	CAP.CERAMIC	10PF	2%	100V	4822 122 32185
C579	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C580,C581	CAP.CERAMIC	39PF	2%	100V	4822 122 31069
C582	CAP.CERAMIC	18PF	2%	100V	4822 122 31061
C583	CAP.CERAMIC	39PF	2%	100V	4822 122 31069

Pos. No.	Description				Ordering Code
C584,C585	CAP.CERAMIC	47PF	2%	100V	4822 122 31072
C586	CAP.CERAMIC	33PF	2%	100V	5322 122 32072
C587,C588	CAP.FOIL	390PF	2%	50V	5322 121 51047
C590,C594	CAP.CERAMIC	1NF	10%	100V	5322 122 32331
C595	CAP.CERAMIC	1NF	2%	63V	4822 122 31746
C596	CAP.CERAMIC	6,8PF	0,25PF	100V	4822 122 31049
C597,C598	CAP.CERAMIC	1NF	10%	100V	5322 122 32331

RESISTORS / U10

R601	RES.METAL FILM	6K19	1%	0,6W	4822 050 26192
R602	RES.METAL FILM	1K78	1%	0,6W	4822 050 21782
R603,R605	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R604	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R606	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R607	RES.METAL FILM	1K78	1%	0,6W	4822 050 21782
R608,R610	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R609	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R611	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R612	RES.METAL FILM	1K78	1%	0,6W	4822 050 21782
R613,R615	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R614	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R616	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R617	RES.METAL FILM	1K27	1%	0,6W	4822 050 21272
R618,R620	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R619	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R621	RES.METAL FILM	464R00	1%	0,6W	4822 050 24641
R622	RES.METAL FILM	3K01	1%	0,6W	4822 050 23012
R623,R624	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R625	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R626	RES.METAL FILM	1K10	1%	0,4W	4822 050 11102
R627	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R628,R629	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R630	RES.METAL FILM	16R2	1%	0,4W	5322 117 10982
R631	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R632,R634	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R633	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R635	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R636,R638	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R637,R639	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R640	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R641,R643	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R644	RES.METAL FILM	2K15	1%	0,6W	4822 050 22152
R645	RES.METAL FILM	1K27	1%	0,6W	4822 050 21272
R651	RES.METAL FILM	464R00	1%	0,6W	4822 050 24641
R652	RES.METAL FILM	40R20	1%	0,6W	4822 050 24029
R653	RES.METAL FILM	348R00	1%	0,6W	4822 050 23481
R654	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509
R655,R656	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R657	RES.METAL FILM	33R20	1%	0,4W	4822 050 13329
R658	RES.METAL FILM	68R1	1%	0,4W	5322 117 10958
R659	RES.METAL FILM	215R	1%	0,4W	5322 117 10986
R661	RES.METAL FILM	75R00	1%	0,4W	4822 050 17509

Pos. No.	Description				Ordering Code
R662	RES.METAL FILM	95R30	1%	0,6W	4822 050 29539
R663	RES.METAL FILM	23R7	1%	0,4W	5322 117 10946
R664	RES.METAL FILM	51R10	1%	0,4W	4822 050 15119
R665	RES.METAL FILM	16R2	1%	0,4W	5322 117 10982
R670,R673	RES.METAL FILM	1K10	1%	0,6W	4822 050 21102
R671	RES.METAL FILM	2K26	1%	0,6W	4822 050 22262
R672	RES.METAL FILM	2K05	1%	0,6W	4822 050 22052
R674	RES.METAL FILM	38K30	1%	0,6W	4822 050 23833
R675	RES.METAL FILM	22R6	1%	0,4W	5322 117 10945
R676	RES.METAL FILM	21K5	1%	0,4W	5322 117 10772
R677,R678	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002
R679	RES.METAL FILM	6K81	1%	0,6W	4822 050 26812
R680	RES.METAL FILM	28R7	1%	0,4W	5322 117 10995
R681-R687	RES.METAL FILM	1K10	1%	0,4W	4822 050 11102
R688	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R689	RES.METAL FILM	38K30	1%	0,4W	4822 050 13833
R690	RES.METAL FILM	10R00	1%	0,4W	4822 050 11009

COILS / U10

L806,L807	COIL	4,7UH	5322 158 10628
L808	COIL	220UH	5322 157 52789

MISCELLANEOUS / U10

X851	PIN FOR MINI COAX CONNECTOR	5322 268 14141
X852	MINI COAX CONNECTOR	5322 265 10266

KEYBOARD UNIT (U12)

UNIT 12 COMPLETE 5322 214 91336

INTEGRATED CIRCUITS / U12

D301	INTEGR.CIRCUIT	SAA3007P	5322 209 72061
D302	INTEGR.CIRCUIT	MM5450N	4822 209 10199

TRANSISTORS, DIODES / U12

H401-H433	LED	TLHY4405	4822 130 83412
H451	DISPLAY	TSM5234P	5322 130 91001
V441,V442	RECTIFIER	BYV95B	4822 130 41486

Pos. No.	Description				Ordering Code

CAPACITORS / U12

C501	CAP.ELECTROLYT.	47UF	50%	10V	4822 124 20678
C502,C504	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C503,C505	CAP.CERAMIC	2,2NF	10%	100V	5322 122 32818
C506	CAP.CERAMIC	22NF	80%	63V	4822 122 30103
C507,C508	CAP.CERAMIC	100PF	2%	100V	4822 122 31316

RESISTORS / U12

R601,R602	POTM.TRIMMER	47K	CARB LIN	0,1W	4822 100 10079
R603,R605	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R604	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002

CRYSTALS / U12

G751	RESONATOR	CSB455A	5322 242 71606

MISCELLANEOUS / U12

S801-S833	KEY (PUSHBUTTON)	4822 276 11076

KEYBOARD UNIT NICAM (U12/N)

UNIT 12/N COMPLETE 5322 214 91341

INTEGRATED CIRCUITS / U12N

D301	INTEGR.CIRCUIT	SAA3007P	5322 209 72061
D302	INTEGR.CIRCUIT	MM5450N	4822 209 10199

DIODES / U12N

H401-H441	LED	TLHY4405	4822 130 83412
H451	DISPLAY	TSM5234P	5322 130 91001
V441,V442	RECTIFIER	BYV95B	4822 130 41486

CAPACITORS / U12N

C501	CAP.ELECTROLYT.	47UF	50%	10V	4822 124 20678
C502-C504	CAP.CERAMIC	10NF		100V	4822 122 31414
C505	CAP.CERAMIC	2,2NF	10%	100V	5322 122 32818
C506	CAP.CERAMIC	10NF		100V	4822 122 31414
C507,C508	CAP.CERAMIC	100PF	2%	100V	4822 122 31316

Pos. No.	Description				Ordering Code

RESISTORS / U12N

R601,R602	POTM.TRIMMER	50K	20%	0,5W	5322 101 11304
R604	RES.METAL FILM	1K00	1%	0,4W	4822 050 11002

CRYSTALS / U12N

G751	RESONATOR	CSB455A	5322 242 71606

MISCELLANEOUS / U12N

S801-S840	KEY (PUSHBUTTON)	4822 276 11076

IEEE-BUS UNIT (U13)

UNIT 13 COMPLETE	5322 214 91338

TRANSISTORS, DIODES / U13

V301,V302	TRANSISTOR	BC548B	4822 130 40937
V303	TRANSISTOR	BC558B	4822 130 44197
V304	TRANSISTOR	PH2369	4822 130 41594
V313	TRANSISTOR	BC558B	4822 130 44197
V314,V315	TRANSISTOR	BC548B	4822 130 40937
V325,V326	TRANSISTOR	BC548B	4822 130 40937
V327	TRANSISTOR	BC558B	4822 130 44197
V328,V329	TRANSISTOR	PH2369	4822 130 41594
V330	TRANSISTOR	BC558B	4822 130 44197
V331,V332	TRANSISTOR	BC548B	4822 130 40937
V403	TRANSISTOR	PC40	5322 130 83608
V405	DIODE	BAT85	4822 130 31983
V406-V412	DIODE	BAW62	4822 130 30613
H306-H309	TRANSIST,PHOTO	CNX36	5322 130 90097

INTEGRATED CIRCUITS / U13

D317	INTEGR.CIRCUIT	PCF84C41AP/089		5322 209 52236
D318	INTEGR.CIRCUIT	PC74HCT02P	PHIN	5322 209 11106
D319	INTEGR.CIRCUIT	SN74LS05N		5322 209 84994
D320	INTEGR.CIRCUIT	SN75160BN		5322 209 73557
D321	INTEGR.CIRCUIT	SN75161BN		5322 209 73556
D322	INTEGR.CIRCUIT	PC74HCT245P	PHIN	5322 209 11117
N310,N311	INTEGR.CIRCUIT	LM393N		4822 209 80797
N323	INTEGR.CIRCUIT	MC7815CT		5322 209 71759

Pos. No.	Description				Ordering Code

CAPACITORS / U13

C501	CAP.ELECTROLYT.	47UF	20%	10V	5322 124 21391
C502,C503	CAP.CERAMIC	10NF		100V	4822 122 31414
C511,C512	CAP.CERAMIC	10NF		100V	4822 122 31414
C513	CAP.ELECTROLYT.	1UF	20%	63V	4822 124 21913
C514,C515	CAP.CERAMIC	33PF	2%	100V	5322 122 32072
C516	CAP.CERAMIC	2200UF	20%	16V	4822 124 21382
C517,C518	CAP.CERAMIC	100NF	10%	100V	5322 126 11584
C519,C521	CAP.ELECTROLYT.	47UF	20%	10V	5322 124 21391
C522-C524	CAP.CERAMIC	10NF		100V	4822 122 31414

RESISTORS / U13

R601	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R602-R605	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R606	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R607	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R608	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R609	RES.METAL FILM	287K	1%	0,4W	5322 117 10994
R610,R611	RES.METAL FILM	16K2	1%	0,4W	5322 117 10981
R612	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R613-R616	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R617	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R618	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R619	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R621	RES.METAL FILM	162K	1%	0,4W	5322 117 10981
R622	RES.METAL FILM	787K	1%	0,4W	5322 117 11023
R623	RES.METAL FILM	16K2	1%	0,4W	5322 117 10981
R624,R625	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R626	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R627	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R628	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R629	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R630	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R631	RES.METAL FILM	787K	1%	0,4W	5322 117 11023
R632-R634	RES.METAL FILM	16K2	1%	0,4W	5322 117 10981
R635	RES.METAL FILM	787K	1%	0,4W	5322 117 11023
R636	RES.METAL FILM	16K2	1%	0,4W	5322 117 10981
R637,R638	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R639-R641	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R642	RES.METAL FILM	1M00	1%	0,4W	4822 050 11005
R643	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R644	RES.METAL FILM	4K64	1%	0,4W	4822 050 14642
R645	RES.METAL FILM	2K74	1%	0,4W	4822 050 12742
R646	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003
R647	RES.METAL FILM	8K66	1%	0,4W	5322 117 10793
R651	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R652	RES.METAL FILM	287R00	1%	0,4W	4822 050 12871
R653	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781
R654	RES.METAL FILM	2K49	1%	0,4W	4822 050 12492
R655-R657	RES.METAL FILM	3K65	1%	0,4W	5322 117 10781

Pos. No.	Description				Ordering Code

CRYSTALS / U13

G781	CRYSTAL	6,000 MHZ			4822 242 70392

MISCELLANEOUS / U13

A751	TRANSFORMER	5322 148 80845
X801	CONNECTOR SUD-D, 9-P MALE	5322 265 40755
X802	CONNECTOR IEEE	5322 267 60162
S803	ADDRESS SWITCH	5322 277 10967

MECHANICAL PARTS, HOUSING / U13

X317	IC SOCKET DIL 28-P	5322 255 44047
--	TEXT PLATE PM9547G	5322 455 71091
--	REAR PLATE PM9547G	5322 447 92209
--	HOUSING PM9547G	5322 447 92211
--	RUBBER FOOT	5322 532 11588
--	HEATSINK	5322 255 41317

IIC-BUS ADAPTER (U13A)

UNIT 13A COMPLETE	5322 214 91339

INTEGRATED CIRCUITS / U13A

D301	INTEGR.CIRCUIT	PC74HCT03P	5322 209 11316

TRANSISTOR, DIODES / U13A

V401-V404	DIODE	BAX12A	5322 130 34605

CAPACITORS / U13A

C501	CAP.CERAMIC	10NF	100V	4822 122 31414

RESISTORS / U13A

R601,R602	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R603,R604	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003

MISCELLANEOUS / U13A

X801	CONNECTOR, 9-P FEMALE	5322 267 50594

The following oscillograms show test patterns with a 4:3 aspect ratio format. Patterns with a 16:9 aspect ratio differ in the numbers of elements but are in general the same.

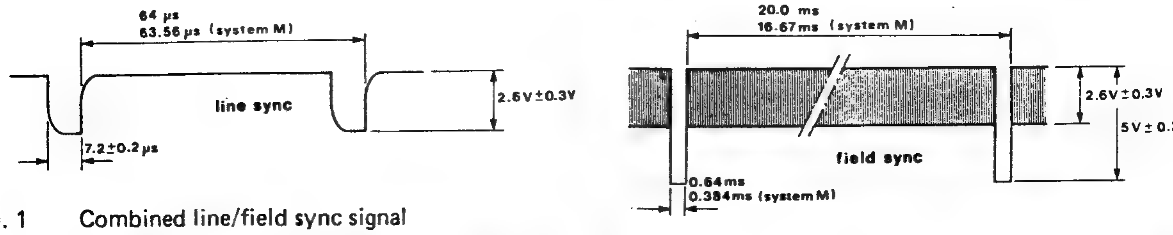
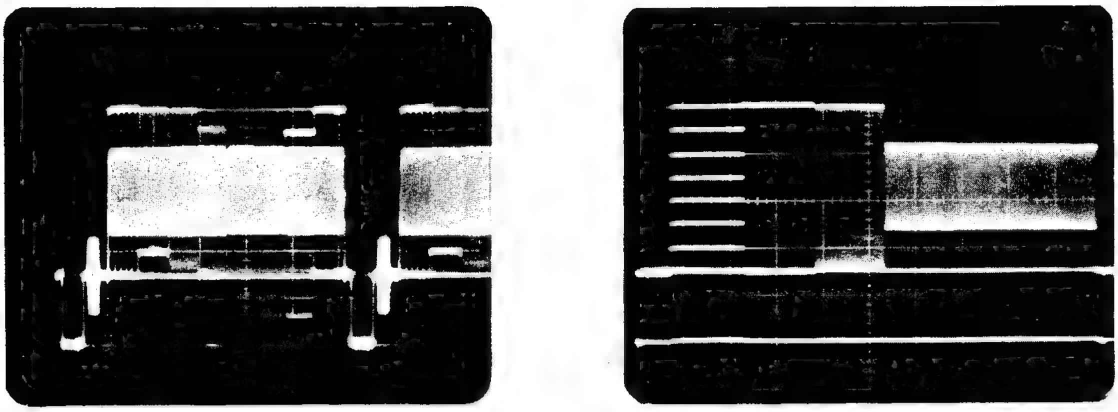


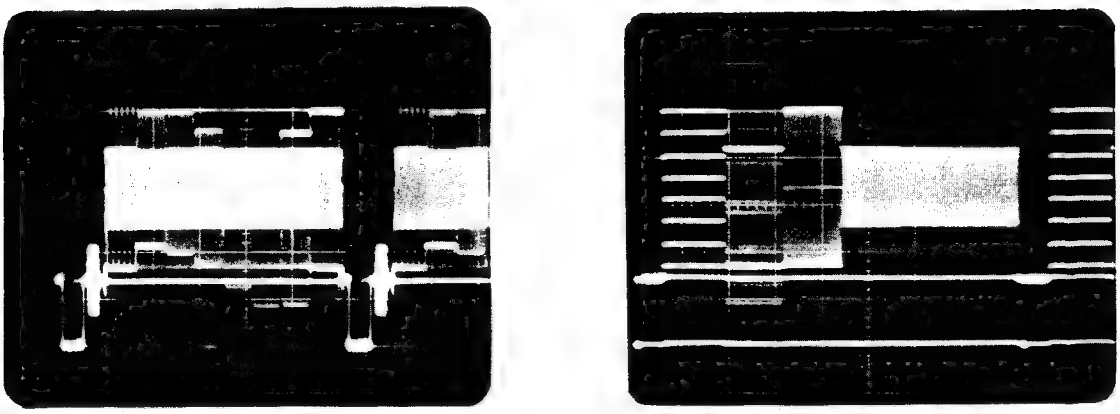
Fig. 1 Combined line/field sync signal



Line

Field

Fig. 2 Greyscale, Colour bar, Multiburst, DEM (PAL D,G,I,N)



Line

Field

Fig. 3 Greyscale, Colour bar, Multiburst, DEM (PAL M, NTSC)

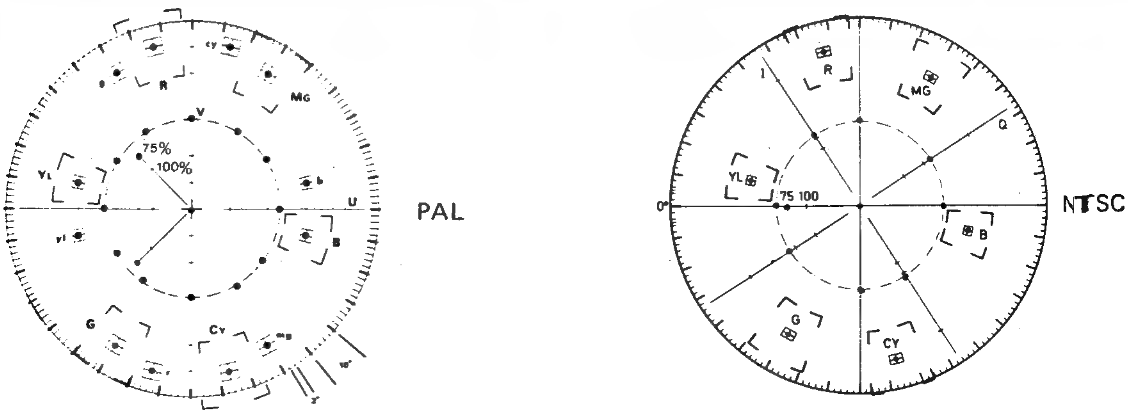
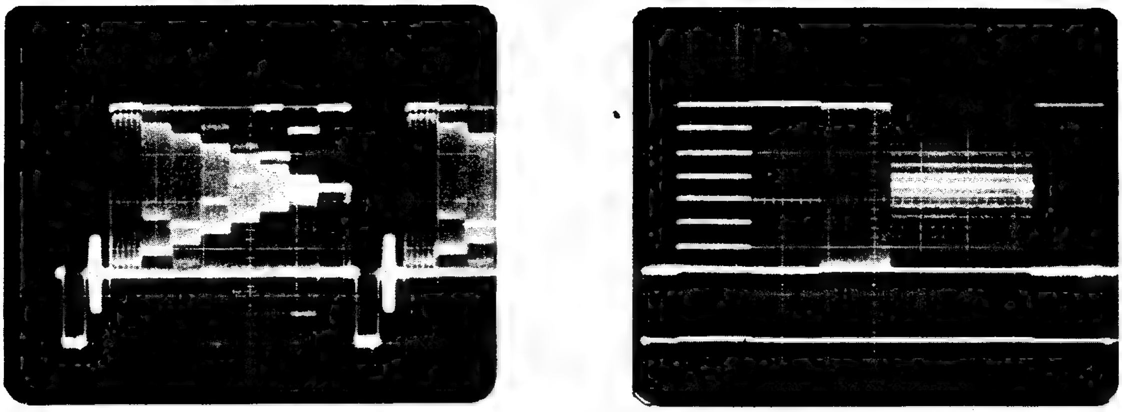
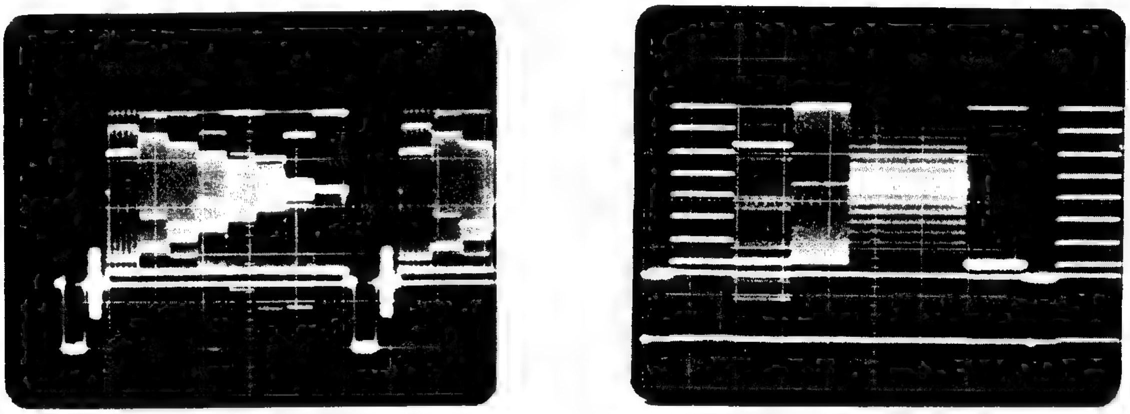


Fig. 4 Greyscale, Colour bar, Multiburst, DEM



Line Field

Fig. 5 Greyscale, Colour bar, Multiburst, VCR (PAL D,G,I,N)



Line Field

Fig. 6 Greyscale, Colour bar, Multiburst, VCR (PAL M, NTSC)

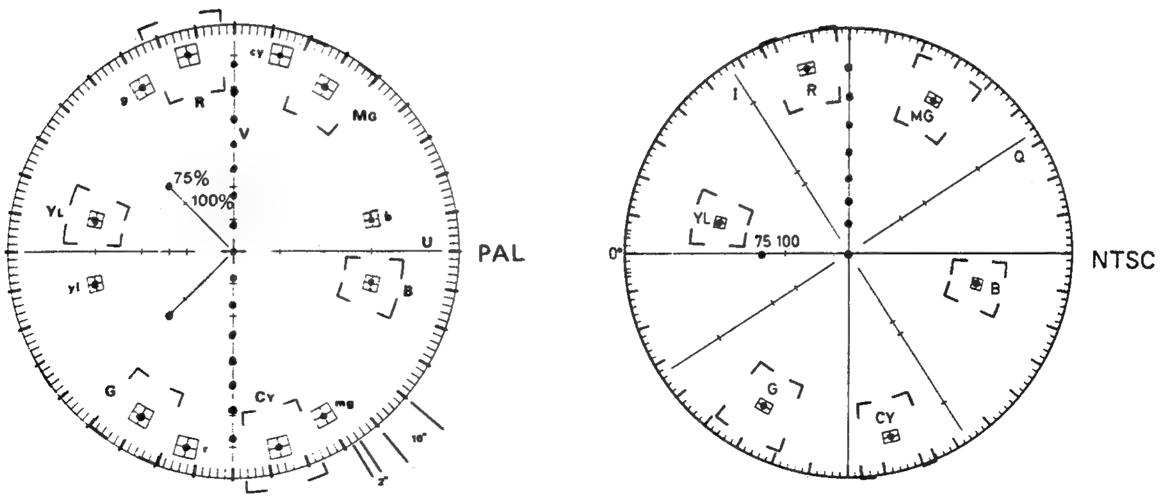


Fig. 7 Greyscale, Colour bar, Multiburst, VCR

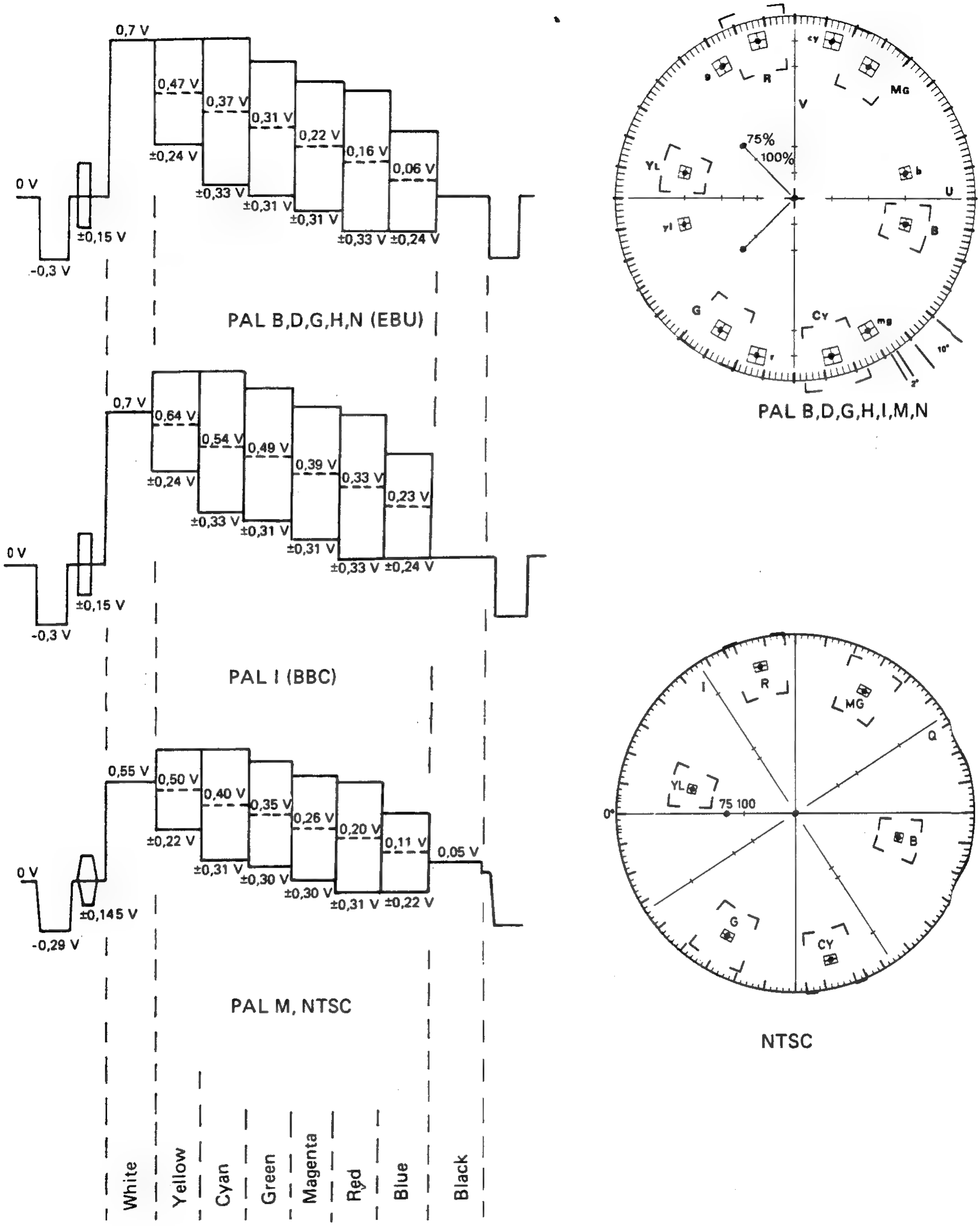


Fig. 8 Colour bar (PAL/NTSC)

The following nomenclature is used to identify and distinguish between color signals (according to CCIR Rec. 471).

	Signal level relative to peak white (%) A B C D	TV System
Color bars	100 / 0 / 75 / 0 (E.B.U.)	B,D,G,H,K,K1,L,N
Color bars	100 / 0 / 100 / 25 (B.B.C.)	PAL I
Color bars	77 / 7.5 / 77 / 7.5	PAL M, NTSC M

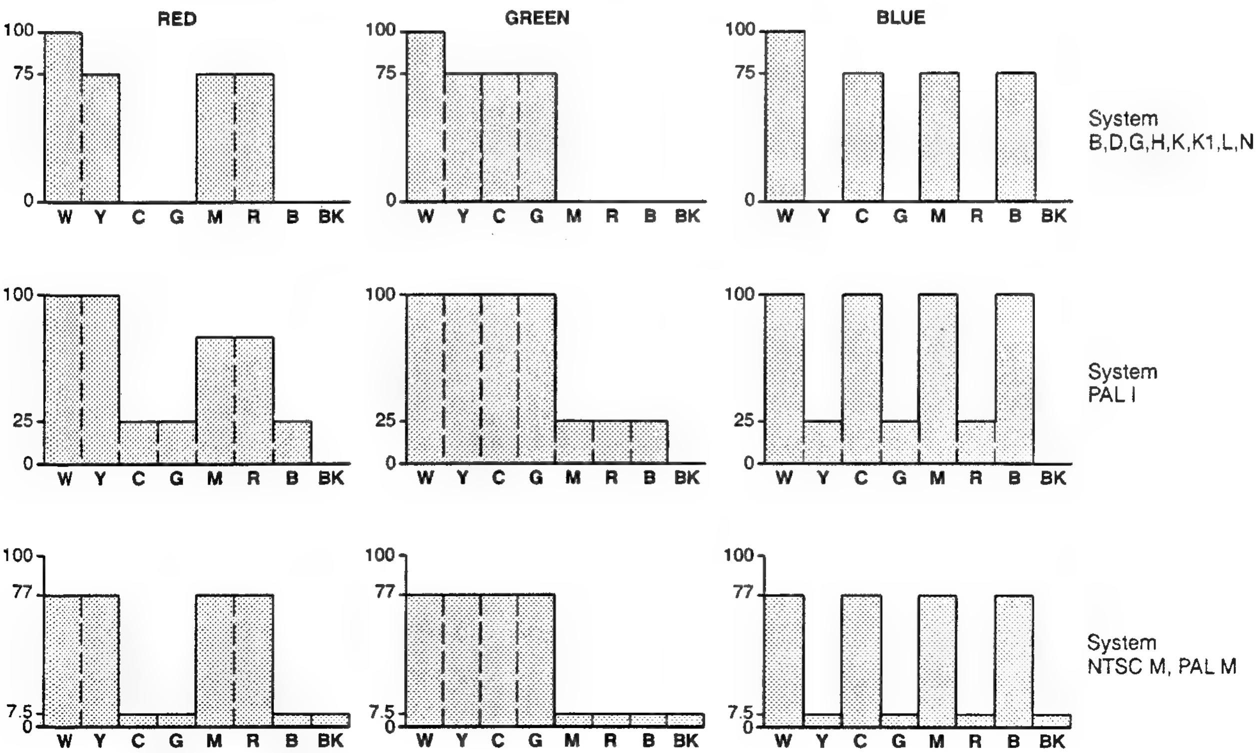
A – the primary color signal level during transmission of the "white" color bar, for example maximum value of E'R, E'G, and E'B.

B – the primary color signal level during transmission of the "black" color bar, for example minimum value of E'R, E'G, and E'B.

C – the maximum level of the primary color signal during transmission of "colored" color bars, for example maximum value of E'R, E'G, and E'B.

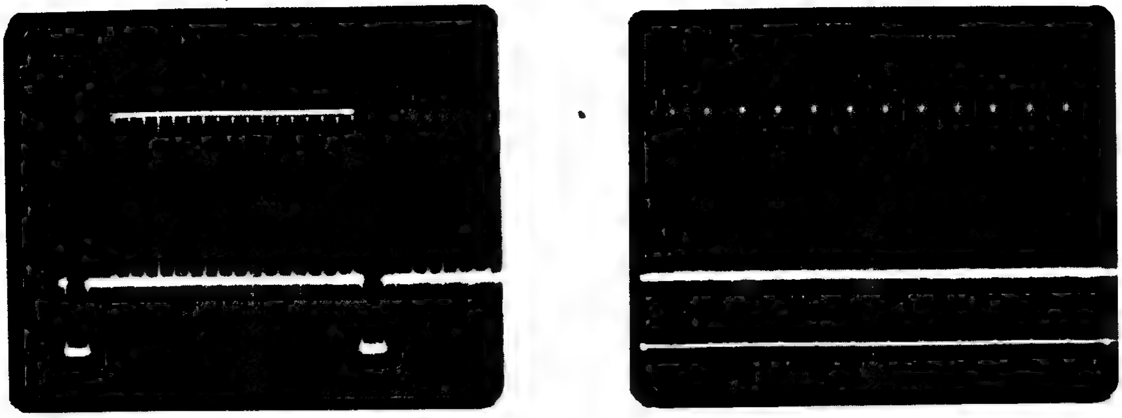
D – the minimum level of the primary color signal during transmission of "colored" color bars, for example minimum value of E'R, E'G, and E'B.

The color bar is generated by the three primary color signals **red, green, and blue** (E'R, E'G, and E'B). The signal amplitudes shown below, are expressed as a percentage of the white level, whereby peak white corresponds to 100%, and the blanking level to zero.



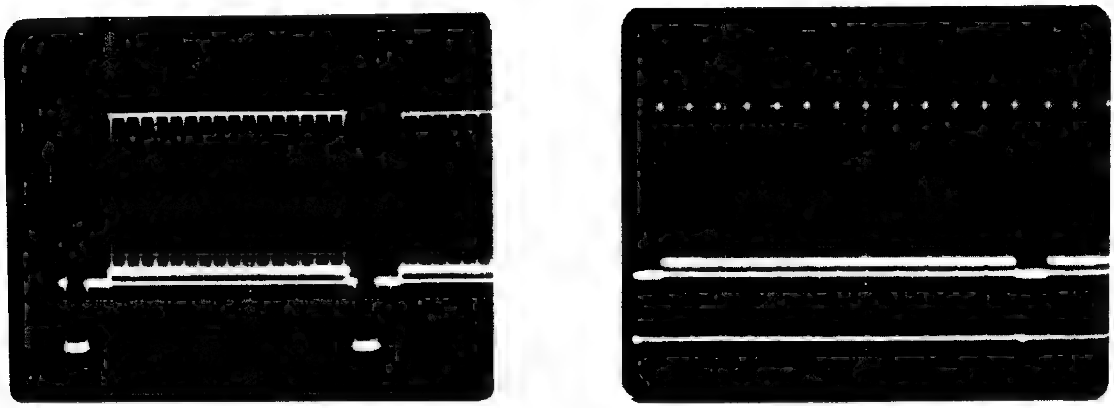
W: white Y: yellow C: cyan G: green M: magenta R: red B: blue BK: black

Fig. 9 Nomenclature of Color Bar Signals



Line Field

Fig. 10 Crosshatch (PAL D,G,I,N)



Line Field

Fig. 11 Crosshatch (PAL M, NTSC)

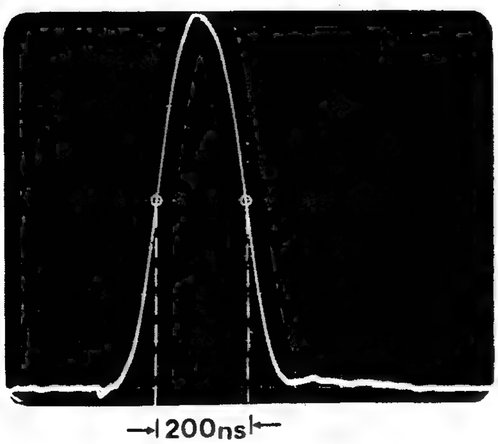


Fig. 12 Crosshatch, pulse form

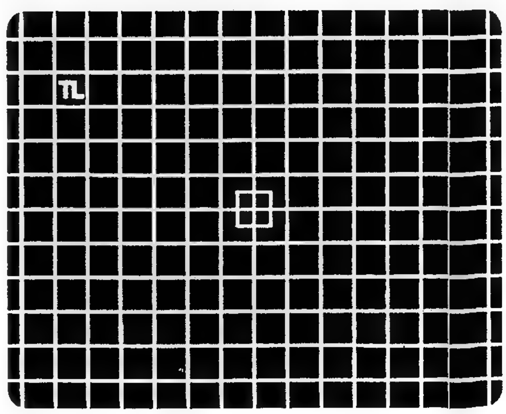
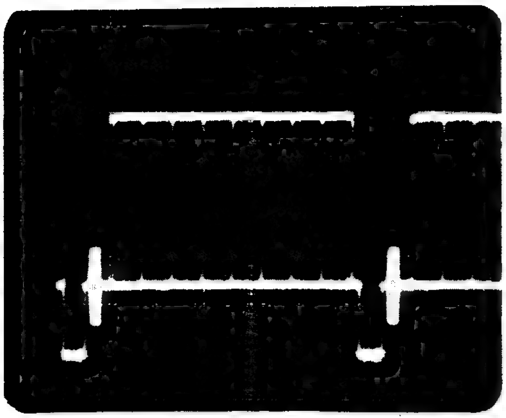
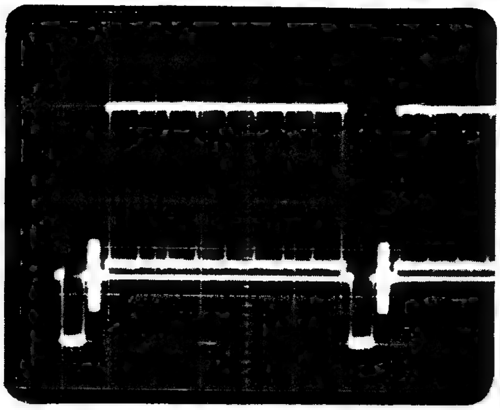


Fig. 13 Crosshatch, centre indication

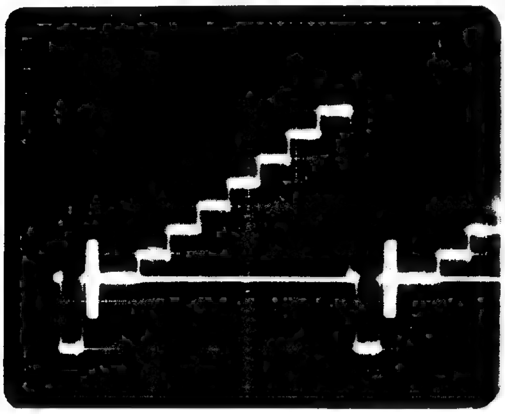


Line PAL D,G,I,N

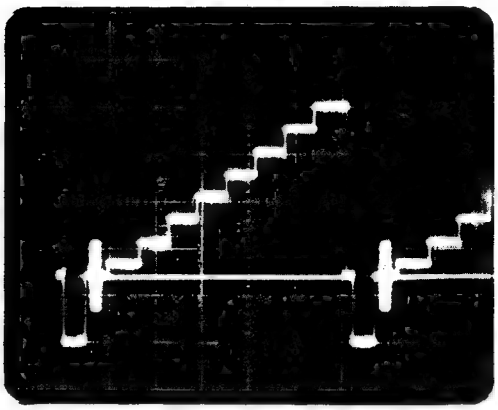


Line PAL M, NTSC

Fig. 14 Checkerboard (PAL/NTSC)

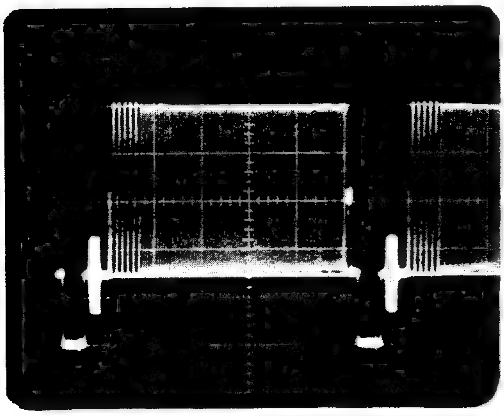


Line PAL D,G,I , N

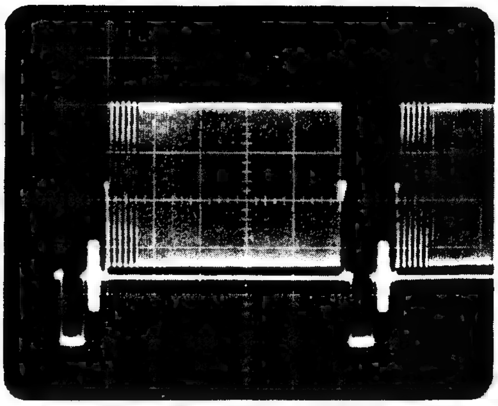


Line PAL M, NTSC

Fig. 15 Greyscale (PAL/NTSC)



Line PAL D,G,I,N



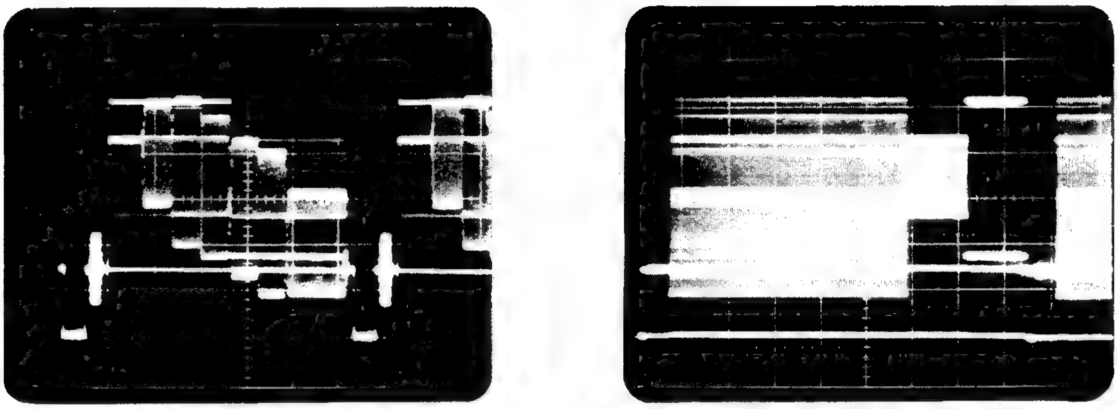
Line PAL M, NTSC

Fig. 16 Multiburst (PAL/NTSC)

Line

Field

Fig. 17 DEM pattern (PAL D,G,I,N)



Line

Field

Fig. 18 DEM pattern (NTSC)

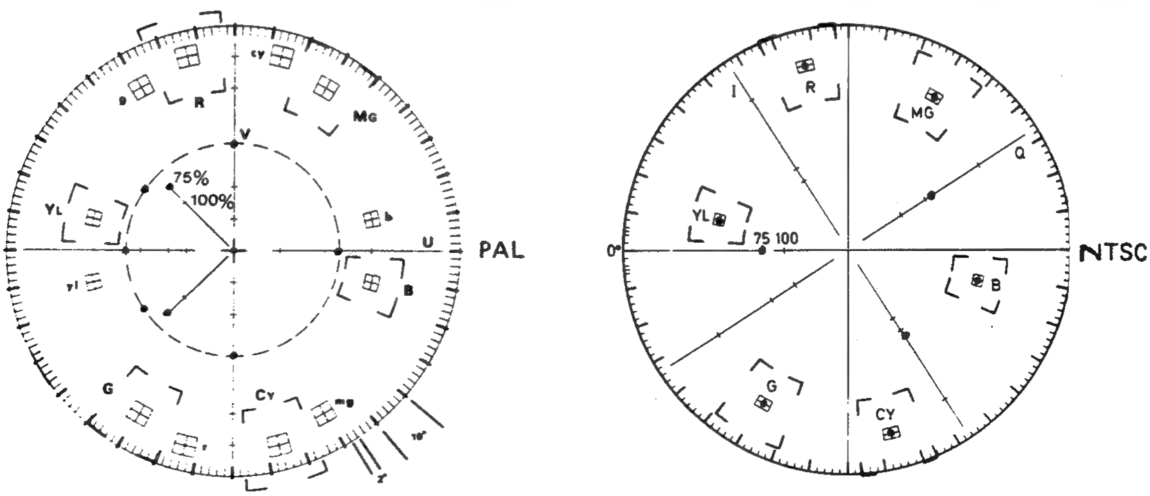
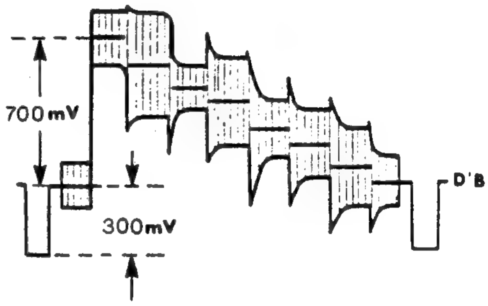


Fig. 19 DEM pattern (vectors)

Bar	Color	Subcarrier f_{OR} = 4.406 MHz Deviation (kHz)	Amplitude (mV)
1	White	0	213
2	Yellow	− 45.5	183
3	Cyan	+280	475
4	Green	+234.5	430
5	Magenta	−234.5	211
6	Red	−280	251
7	Blue	+ 45.5	251
8	Black	0	213
Identification line		+350	540

Transmission of D'R signal

Bar	Color	Subcarrier f_{OB} = 4.250 MHz Deviation (kHz)	Amplitude (mV)
1	White	0	166
2	Yellow	−230	362
3	Cyan	+ 77.6	168
4	Green	−152.4	279
5	Magenta	+152.4	210
6	Red	− 77.6	210
7	Blue	+230	276
8	Black	0	166
Identification line		−350	497



Transmission of D'B signal

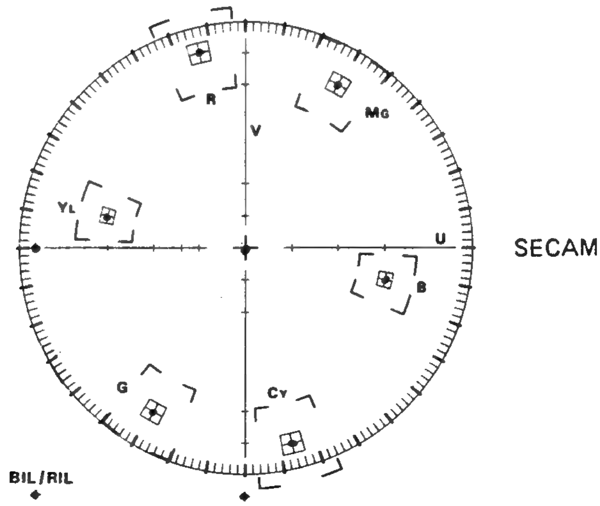
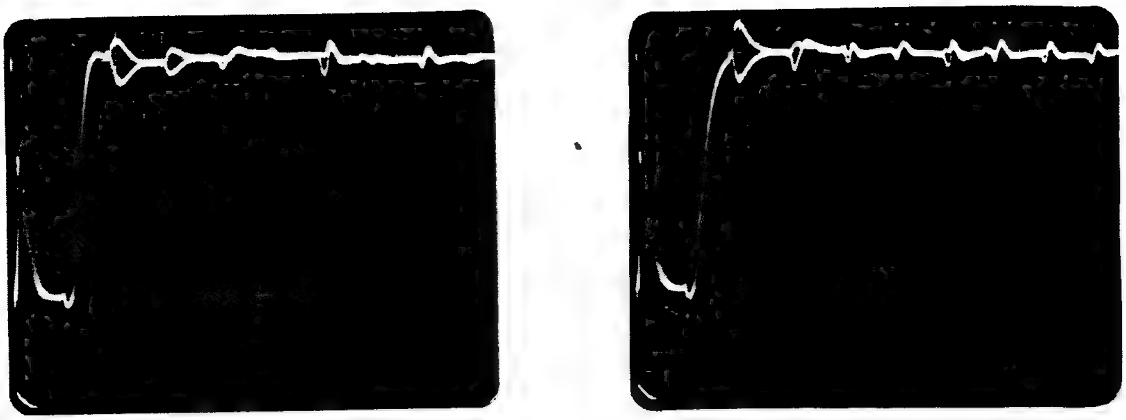


Fig. 20 TV System SECAM Color Bar
Amplitudes, Frequency Deviations and Composite Signal for Color Bar at 75 % Amplitude (100 / 0 / 75 / 0)



DR component DB component

Fig. 21 Colour bar (SECAM), Chroma amplitude measured with Vecamscope TTV 8300

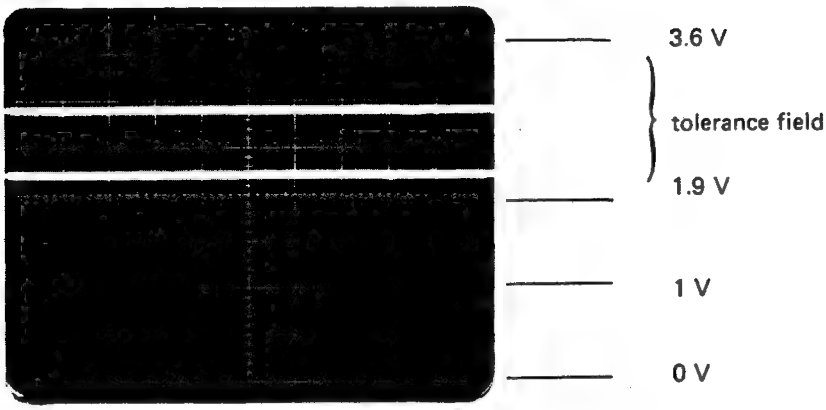


Fig. 22 DC-levels at sampling times (SECAM)

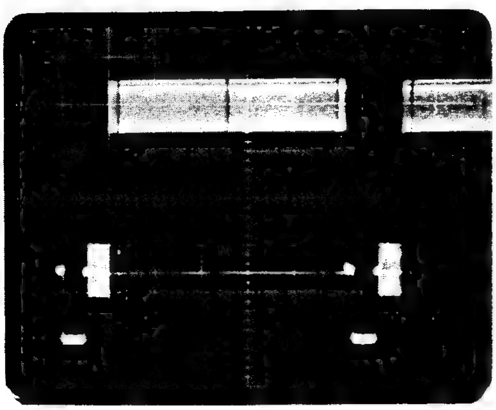


Fig. 23 White, Centre cross (SECAM)

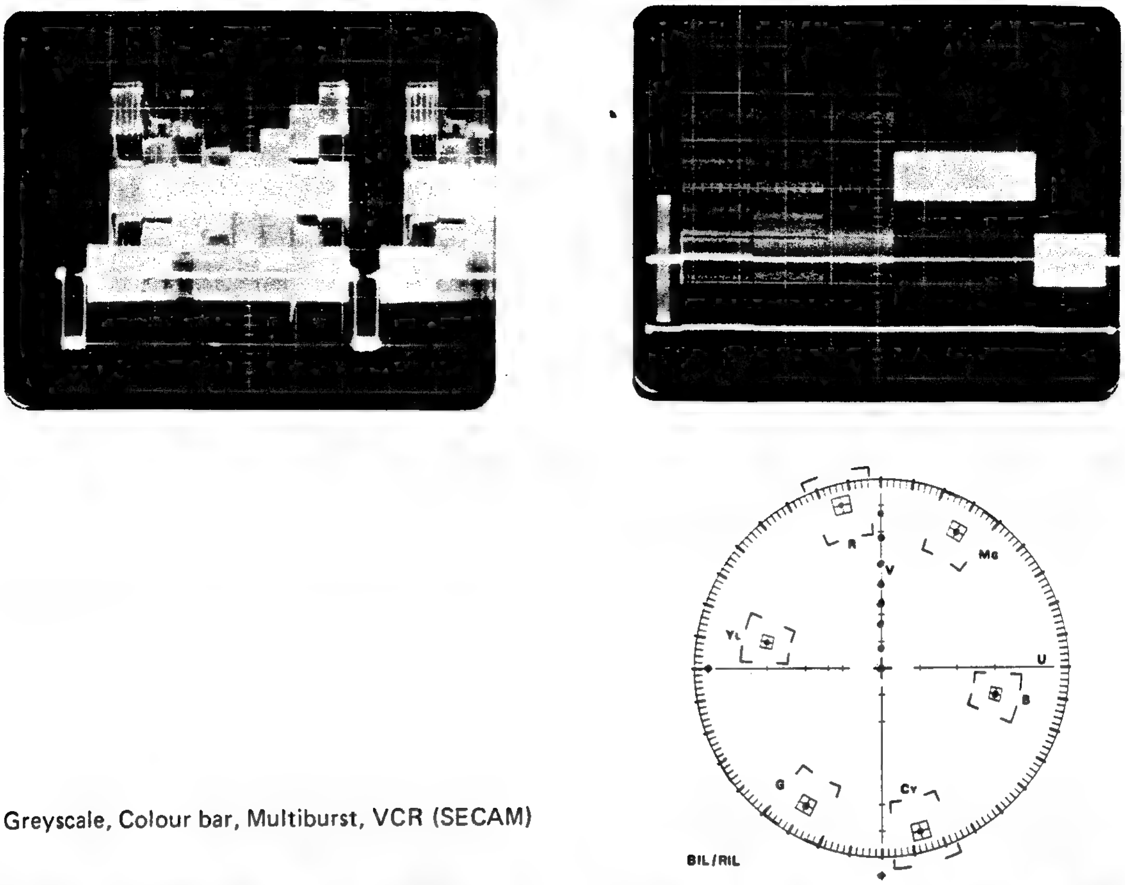


Fig. 24 Greyscale, Colour bar, Multiburst, VCR (SECAM)

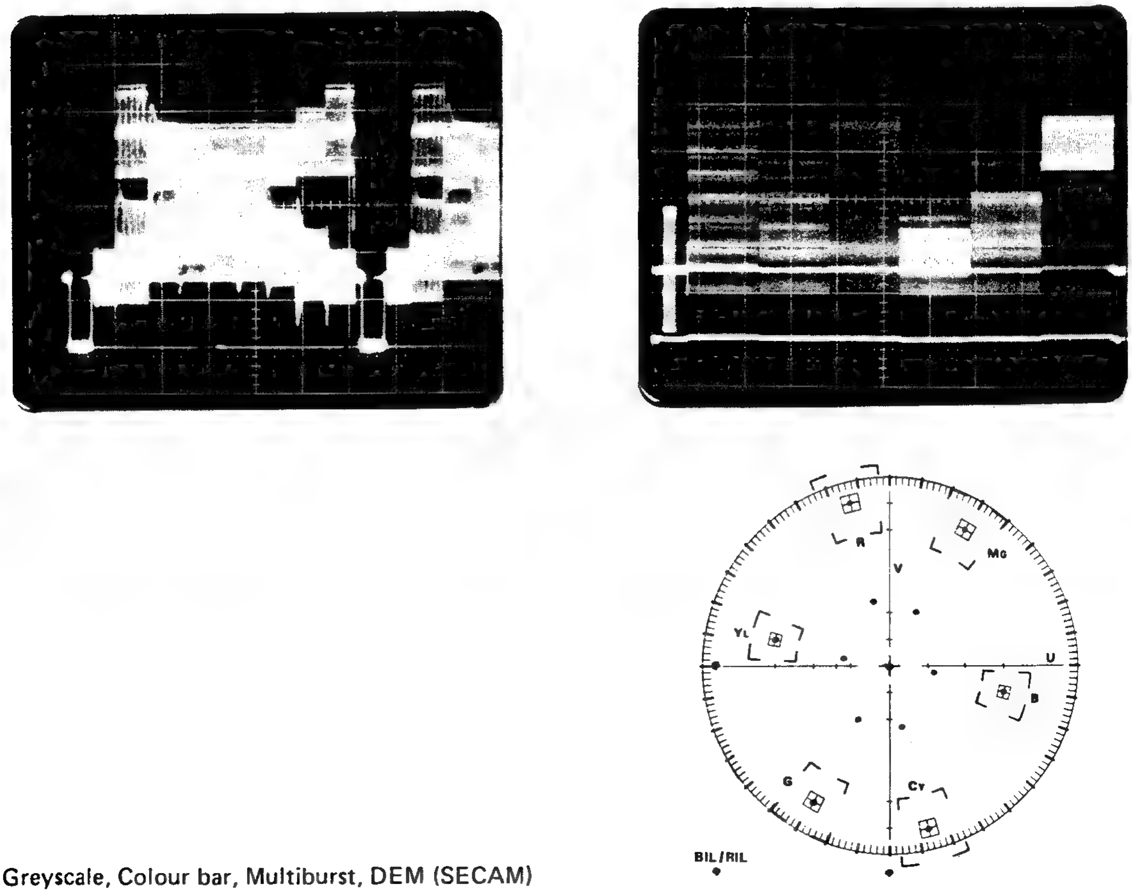


Fig. 25 Greyscale, Colour bar, Multiburst, DEM (SECAM)

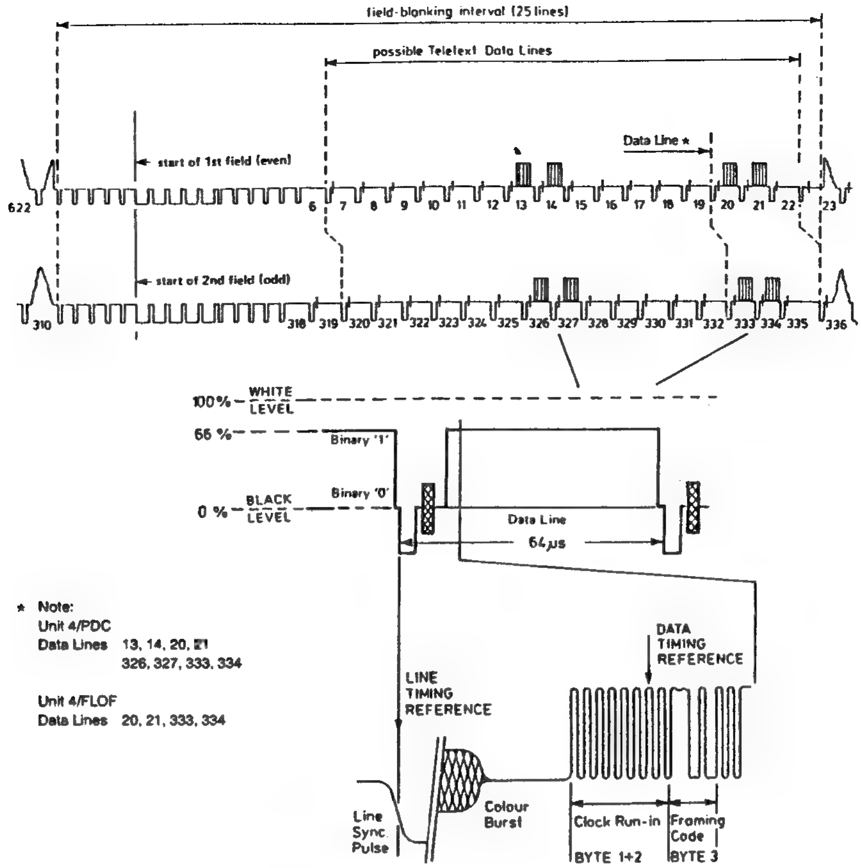


Fig. 26 Identification and levels of Teletext data lines

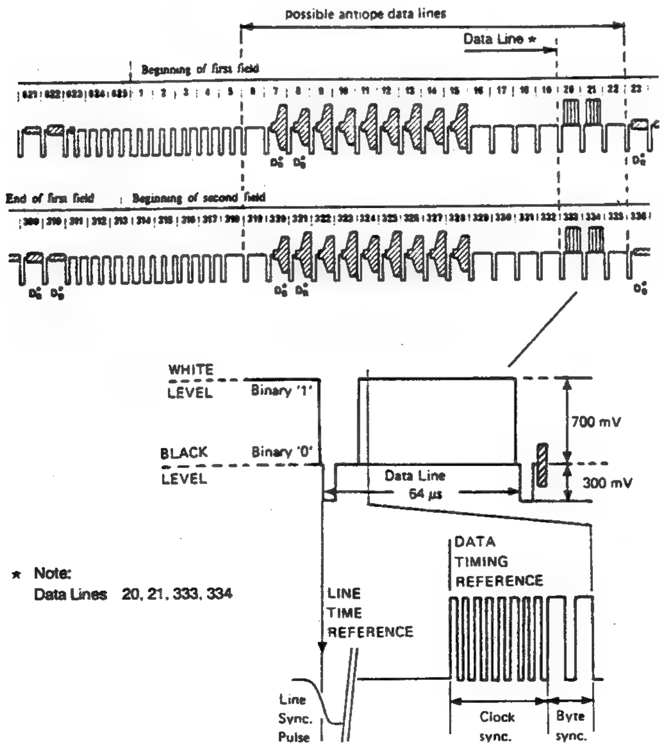
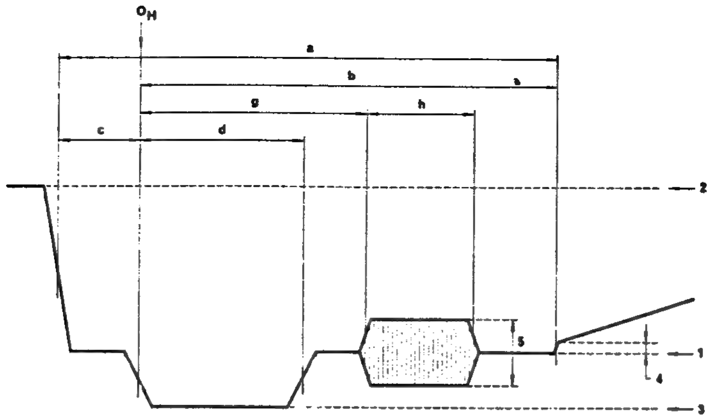
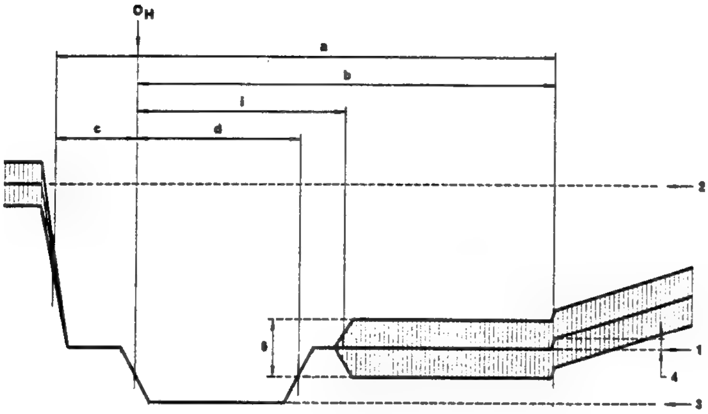


Fig. 27 Identification and levels of Antiope data lines



PAL and NTSC

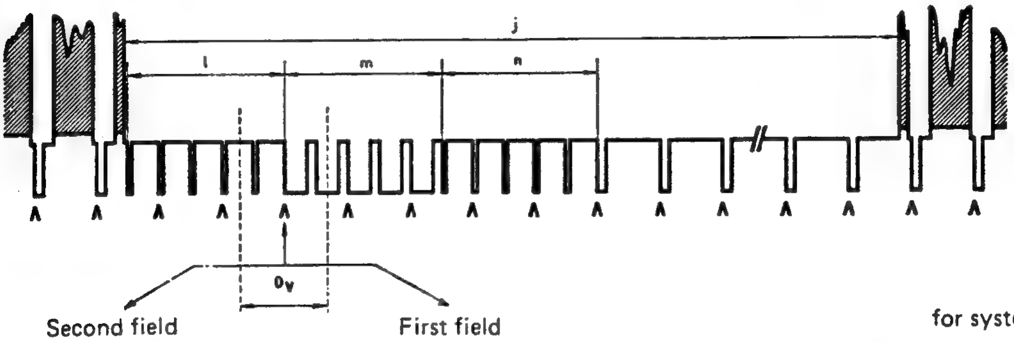


SECAM

TV system		PAL B,D,G,H,I	PAL N	PAL M	NTSC M	SECAM B,D,G,H,K,K1,L
1 blanking level	%	0	0	0	0	0
2 peak white-level	%	100	100	100	100	100
3 synchronising level	%	-43	-43	-40	-40	-43
4 difference of black and blanking levels	%	0	0	7.5±2.5	7.5±2.5	0
5 peak-to-peak value of burst	%	43 (300 mV)	43	43	40	–
tolerance of subcarrier burst	%	±10 (±3 PAL I)	±10	±10	±10	–
6 peak-to-peak value of colour sub-carrier	D'B	–	–	–	–	166 mV±20 mV
	D'R	–	–	–	–	214 mV±26 mV
a Line-blanking interval	(μs)	12±0.3	12±0.3			12±0.3
c Front porch	(μs)	1.65±0.1	1.5±0.3	1.27...2.54	1.27...2.22	1.5±0.3
d Synchronising pulse	(μs)	4.7±0.2	4.7±0.2	4.19...5.71	4.7±0.1	4.7±0.2
g Start of sub-carrier burst	(μs)	5.6±0.1	5.6±0.1	5.8±0.1	4.71...5.71	–
h Duration ob sub-carrier burst	(μs)	2.25±0.23	2.25±0.23	2.52±0.28	2.23...3.11	–
i Blanking of chrominance sub-carrier	(μs)	–	–	–	–	5.6±0.2

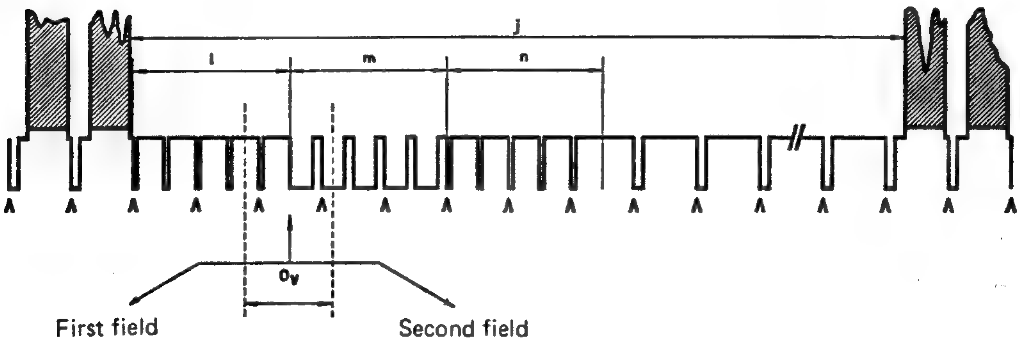
Fig. 28 Levels in the composite signal and details of line-synchronising signals

Symbol	Characteristics	M	N	B,G,H,I,D, K,K1,L
v	Field period (ms)	16.6833	20	20
j	Field-blanking period	21 H+a	25 H+a	25 H+a
l	Duration of first sequence of equalising pulses	3 H	2.5 H	2.5 H
m	Duration of sequence of synchronising pulses	3 H	2.5 H	2.5 H
n	Duration of second sequence of equlising pulses	3 H	2.5 H	2.5 H
p	Duration of equalising pulse (µs)	2.3 ±0.1	2.35 ±0.1	2.35 ±0.1
q	Duration of field-synchronising pulse (µs)	27.1 nominal value	27.3 nominal value	27.3 nominal value
r	Interval between field-synchronising pulses (µs)	4.7 ±0.1	4.7 ±0.1	4.7 ±0.1



for system B,G,H,I,D
K,K1,L,N

Signal at beginning of each first field



Signal at beginning of each second field

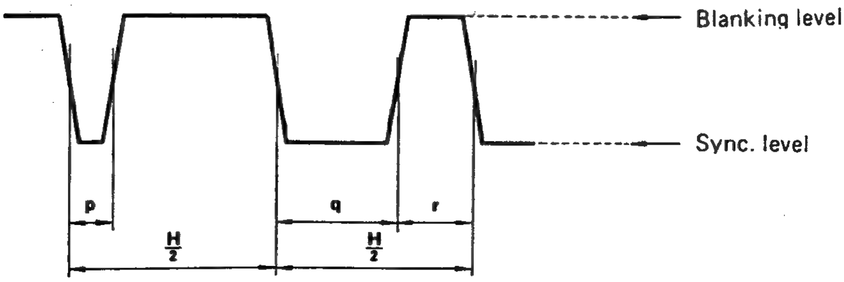
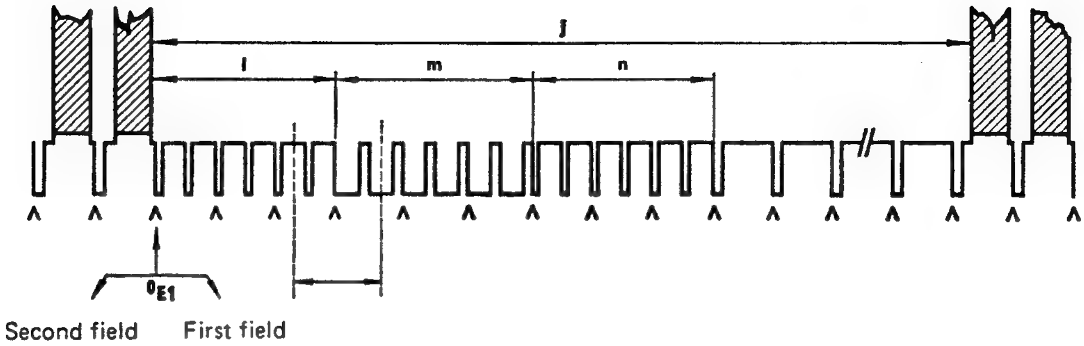
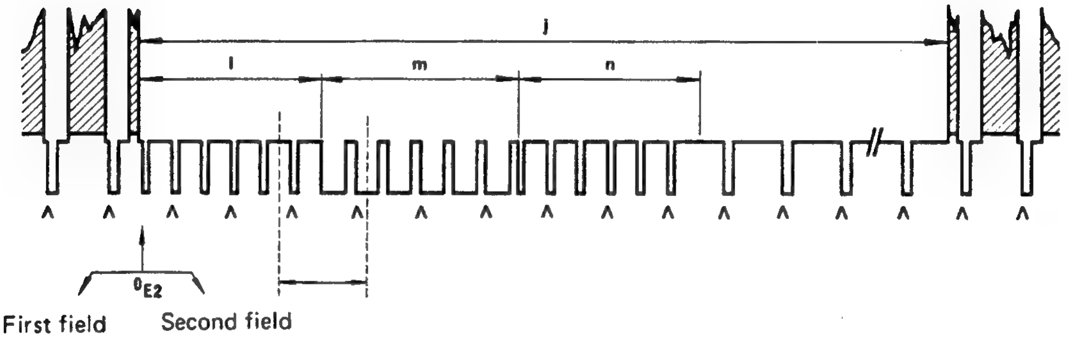


Fig. 29 Details of field-synchronising waveforms (all systems except E and M)



Signal at beginning of each first field



Signal at beginning of each second field

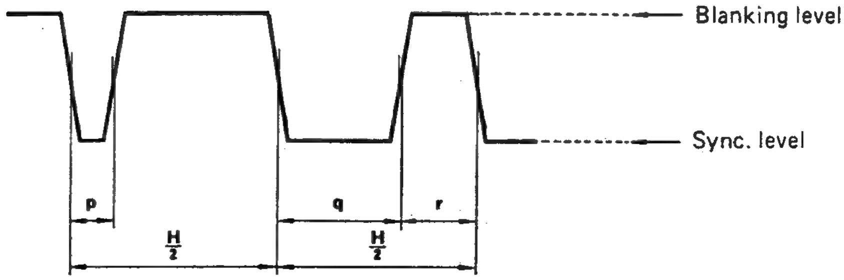


Fig. 30 Details of field-synchronising waveforms (system M)

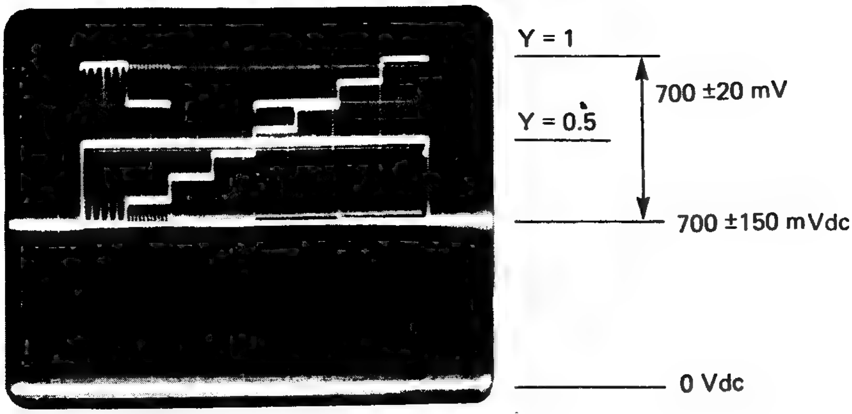
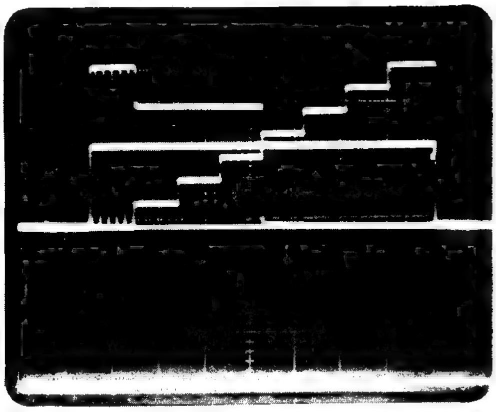


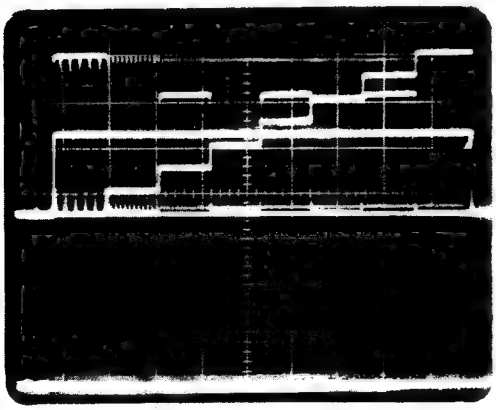
Fig. 31 Output 'RED'



amplitudes

see fig. 31

Fig. 32 Output 'GREEN'



amplitudes

see fig. 31

Fig. 33 Output 'BLUE'

R–G–B outputs,
Patterns: Greyscale, Colour bar, Multiburst, DEM (PAL)

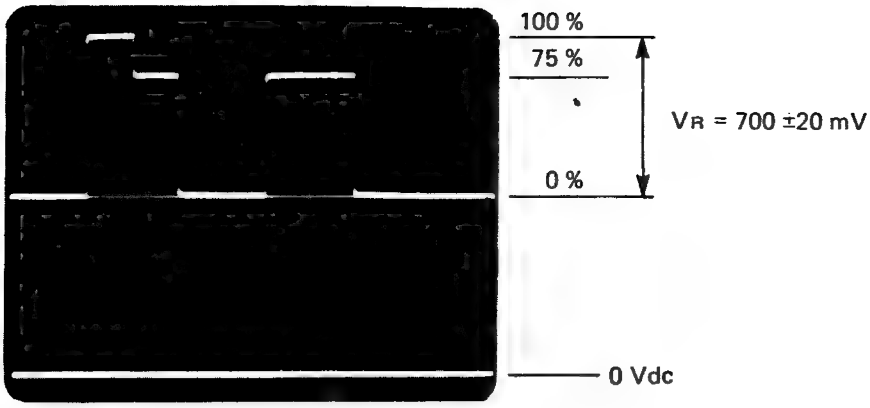


Fig. 34 Output 'RED'

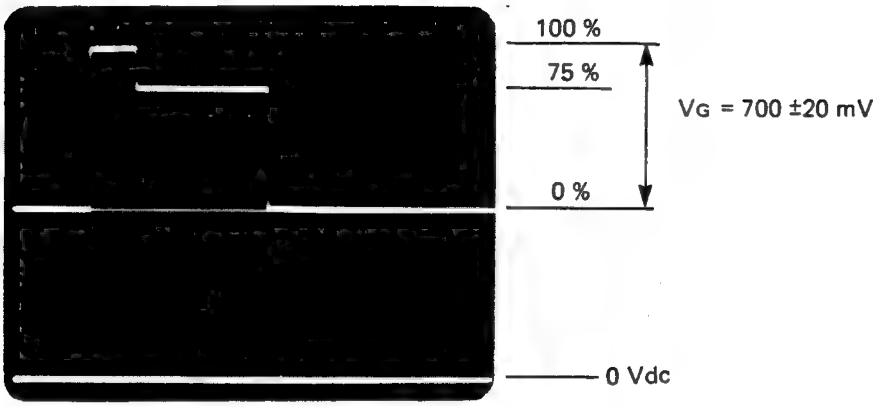


Fig. 35 Output 'GREEN'

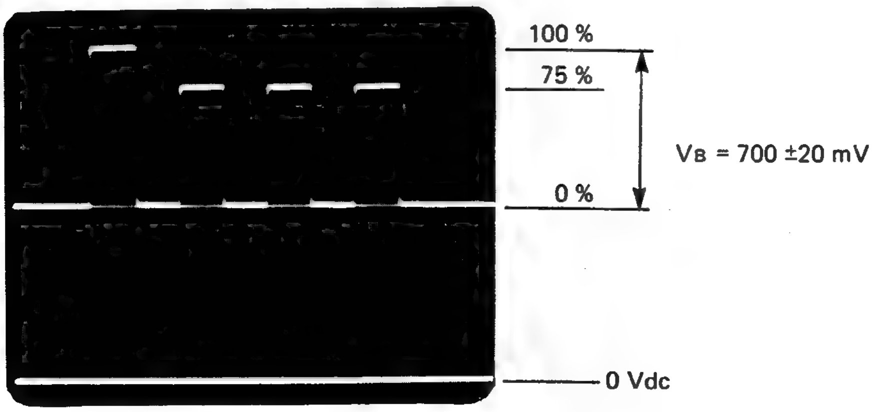


Fig. 36 Output 'BLUE'

R–G–B outputs,
Pattern: Colour bar, PAL (not PAL I)

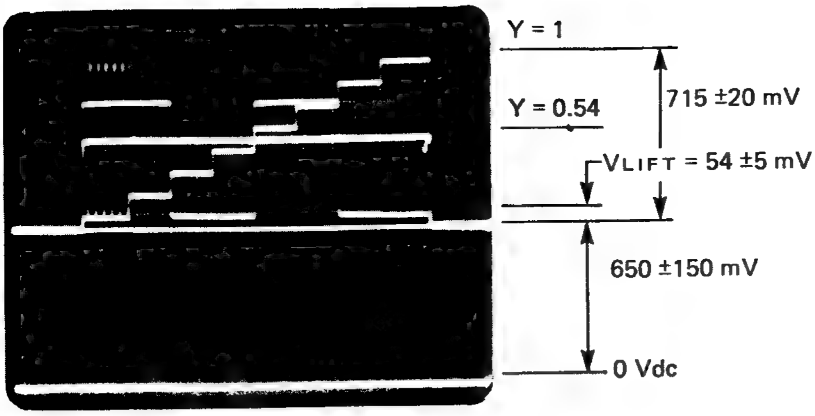
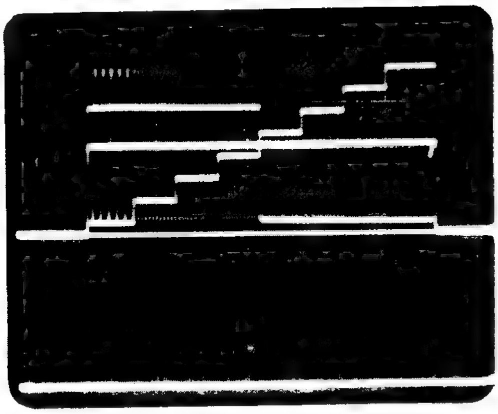
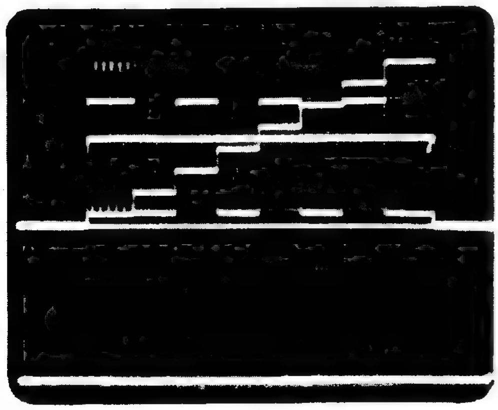


Fig. 37 Output 'RED'



amplitudes
see fig. 37

Fig. 38 Output 'GREEN'



amplitudes
see fig. 37

Fig. 39 Output 'BLUE'

R–G–B outputs,
Patterns: Greyscale, Colour bar, Multiburst, DEM (NTSC)

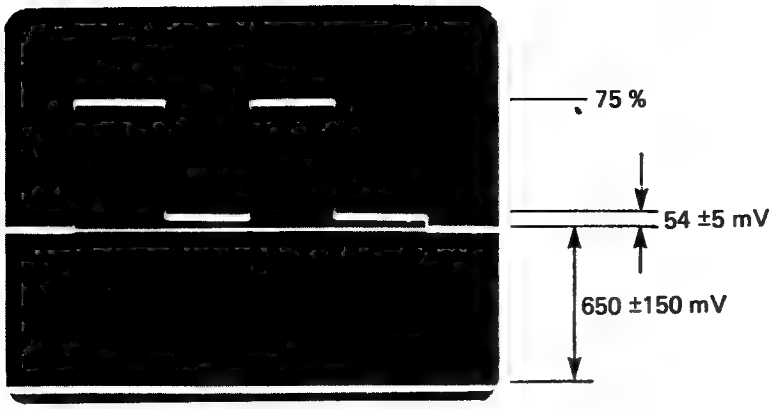


Fig. 40 Output 'RED'

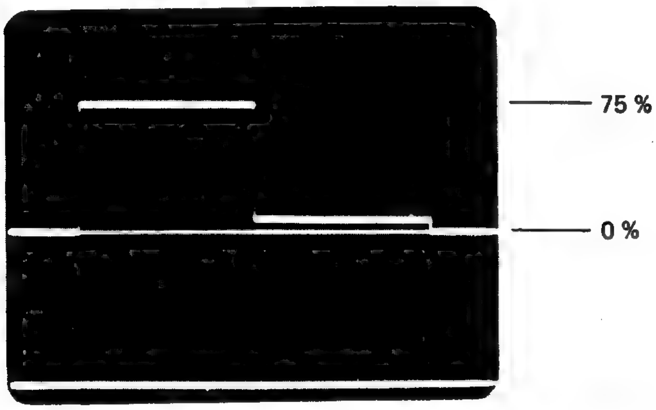


Fig. 41 Output 'GREEN'

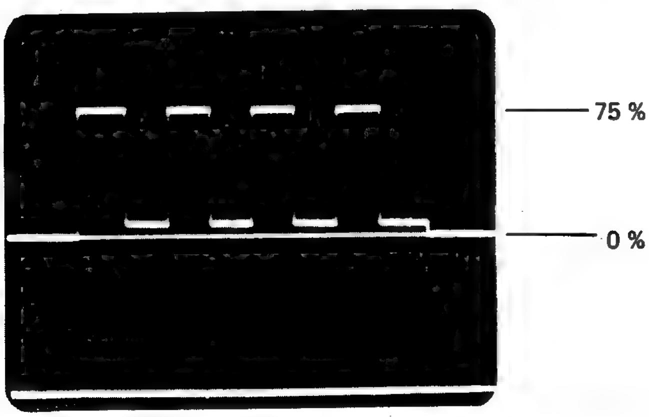


Fig. 42 Output 'BLUE'

R–G–B outputs,
Pattern: Colour bar (PAL M/NTSC)

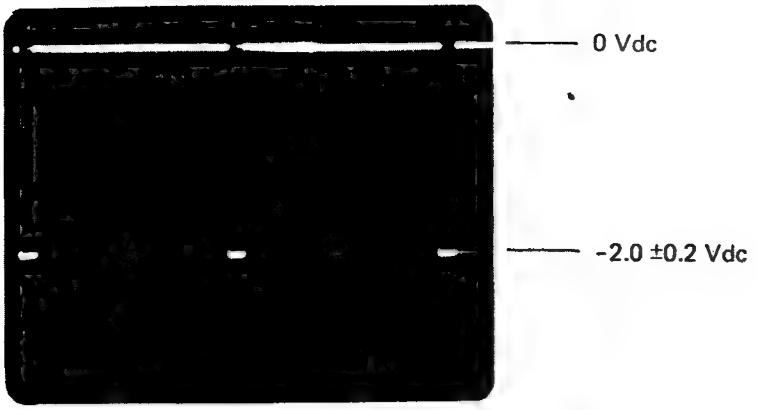


Fig. 43 R–G–B, OUTPUT SYNC

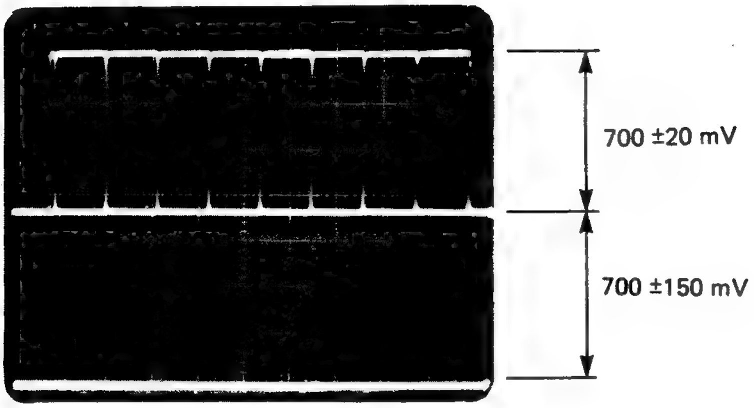


Fig. 44 R–G–B outputs 'RED, GREEN, BLUE'
Pattern: Checkerboard (PAL/SECAM, not system M)

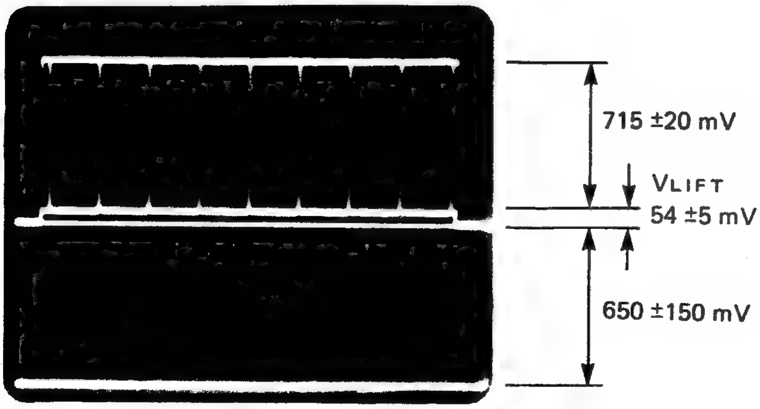


Fig. 45 R–G–B outputs 'RED, GREEN, BLUE'
Pattern: Checkerboard (PAL M/NTSC)

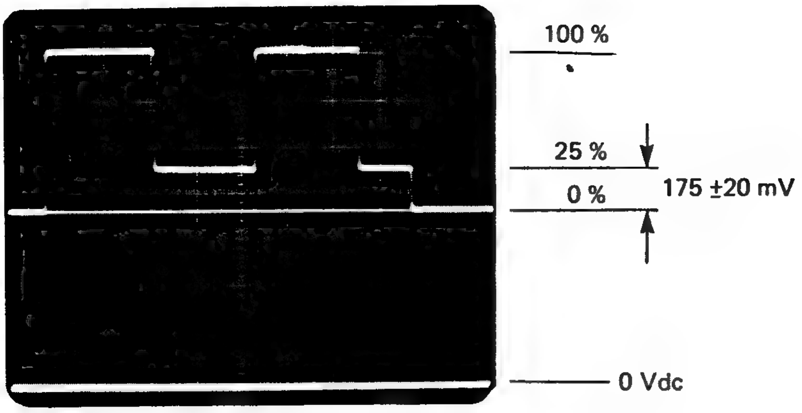


Fig. 46 Output 'RED'

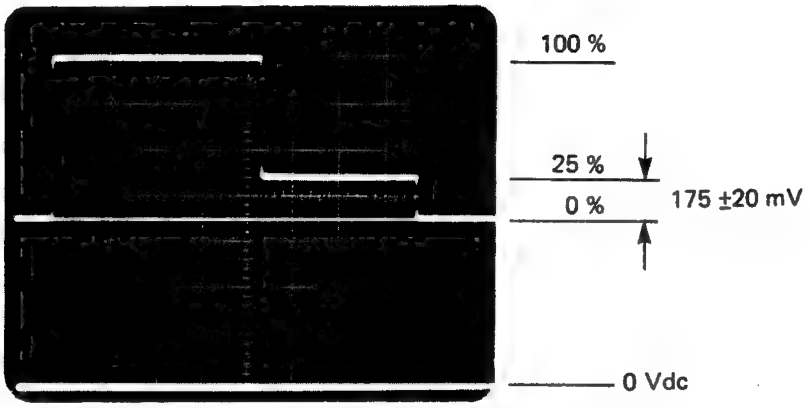


Fig. 47 Output 'GREEN'

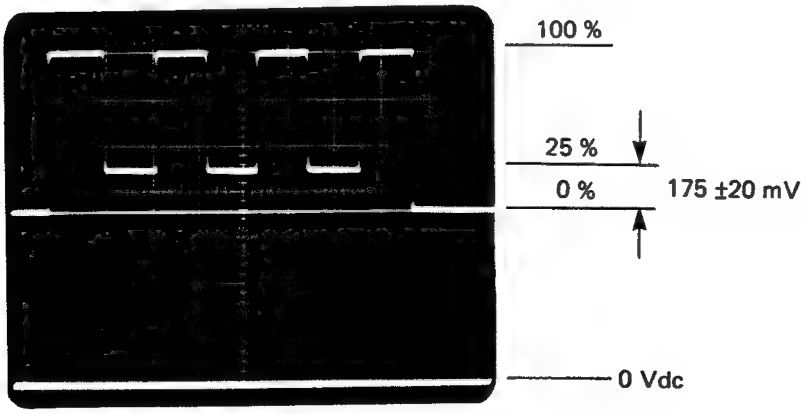


Fig. 48 Output 'BLUE'

R–G–B outputs,
Pattern: Colour bar (PAL I)

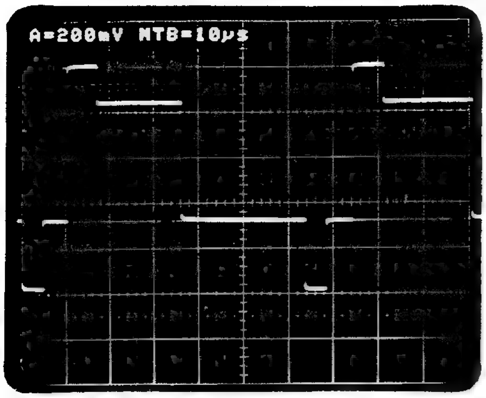


Fig. 49 Sync in GREEN
TV systems PAL D,G,I,N
Colour bar

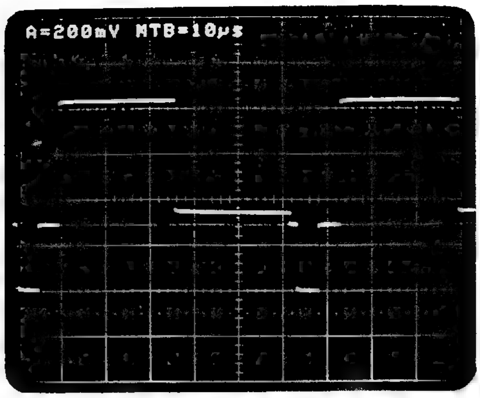


Fig. 50 Sync in GREEN
TV systems NTSC, PAL M
Colour bar

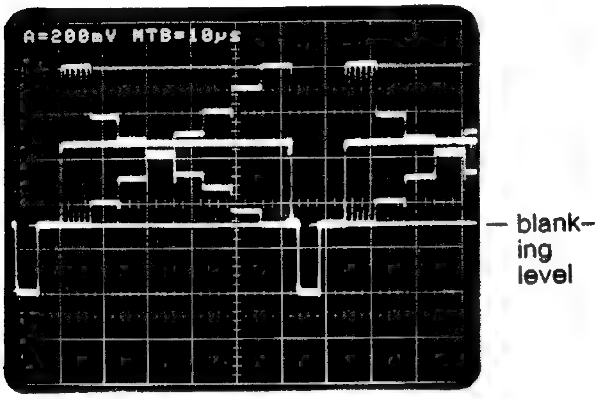


Fig. 51 Y-signal PAL D,G,I,N

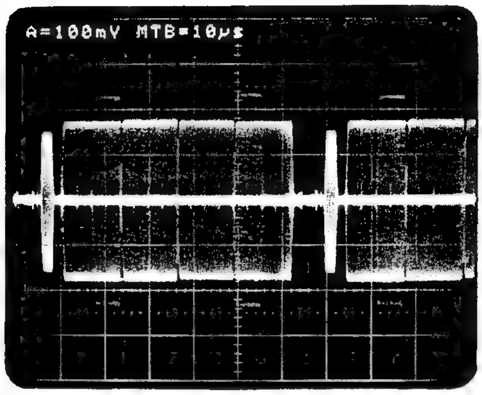


Fig. 52 Chroma signal PAL D,G,I,N

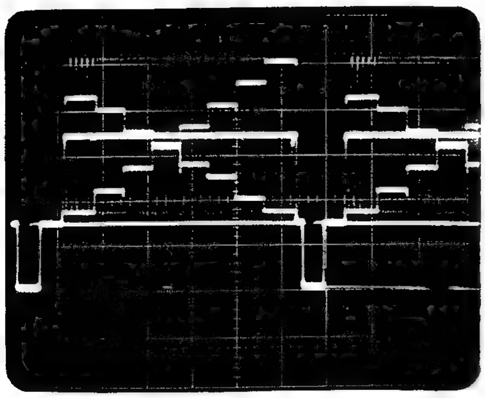


Fig. 53 Y-signal PAL M, NTSC

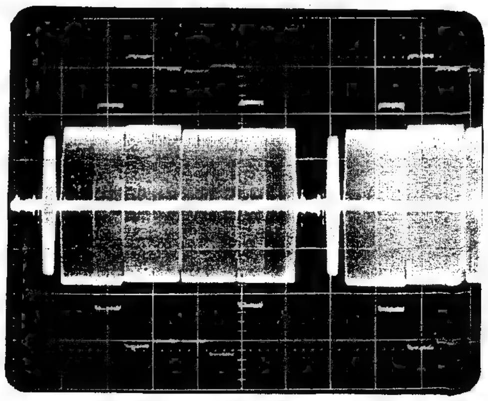


Fig. 54 Chroma signal PAL M, NTSC

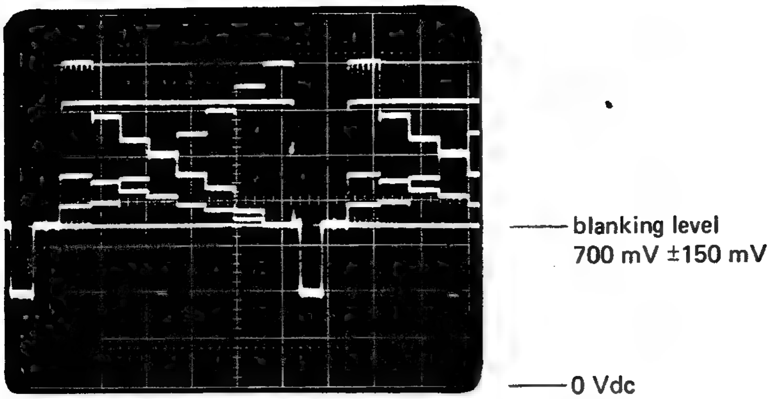


Fig. 55 Y-signal SECAM

Fig. 51 to 55 show the combined pattern: Greyscale, Colour bar, Multiburst and DEM

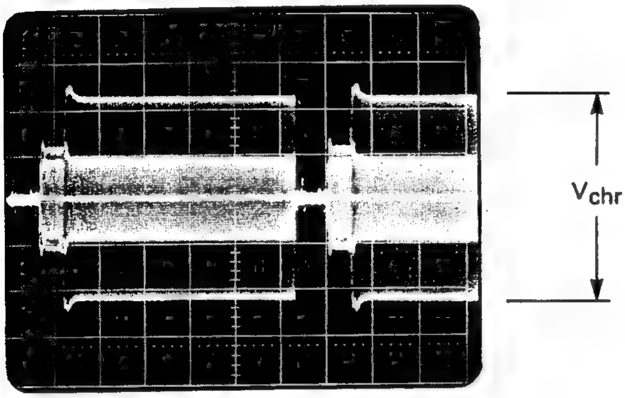


Fig. 56 Chroma signal SECAM
pattern purity cyan

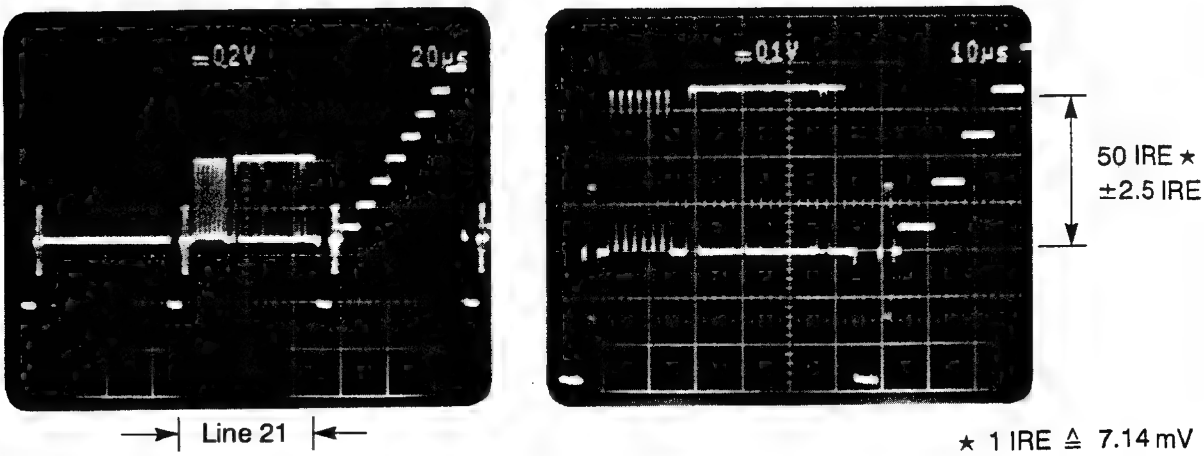


Fig. 57 Identification and levels of Closed Caption (CC)

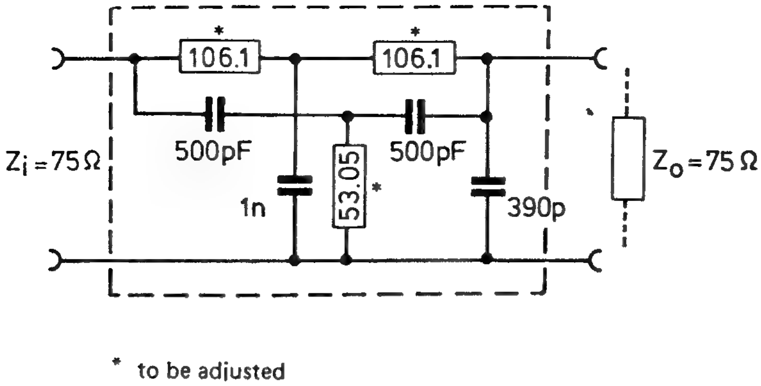


Fig. 58 Notch filter 3 MHz

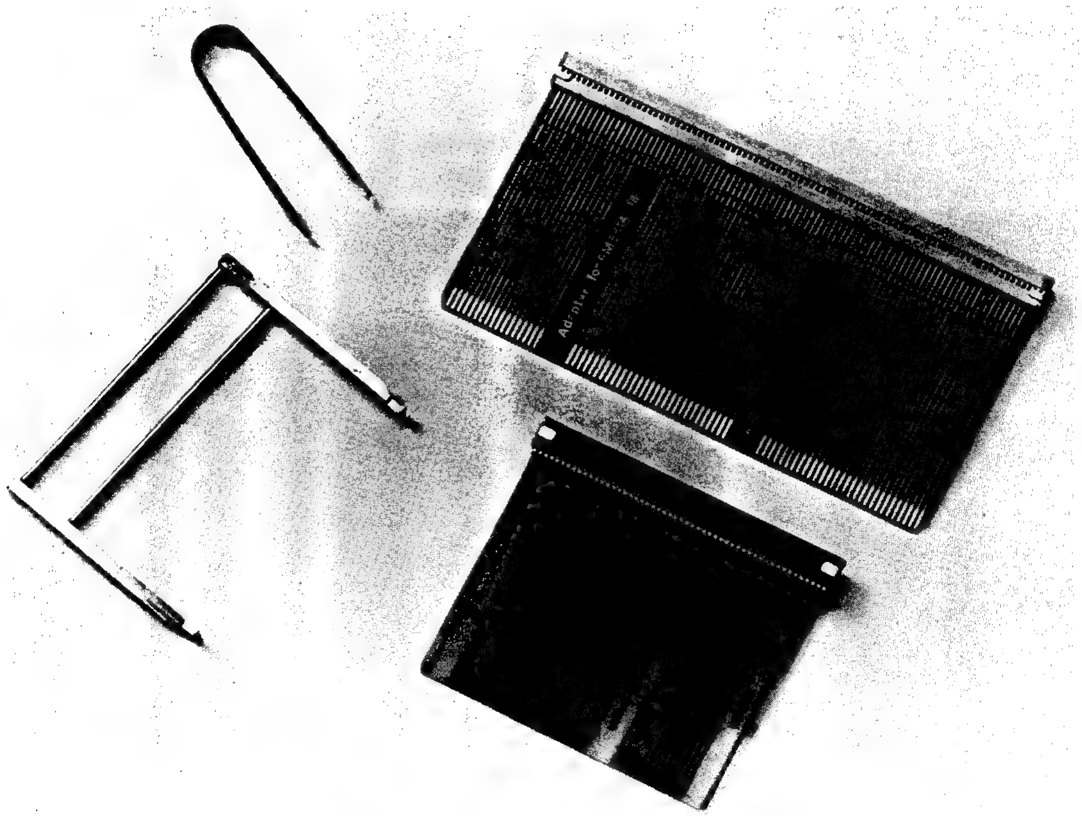
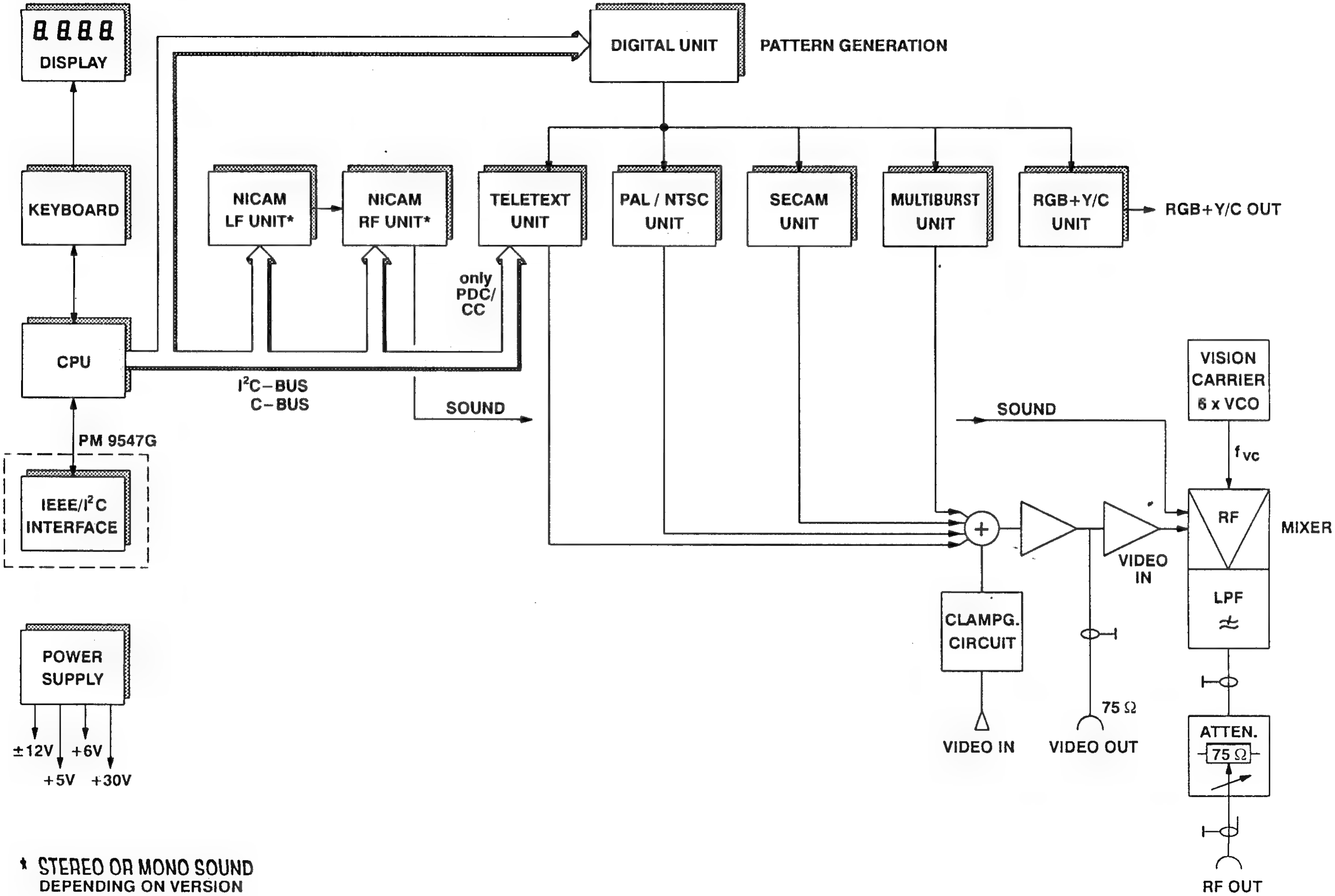


Fig. 59 Service kit

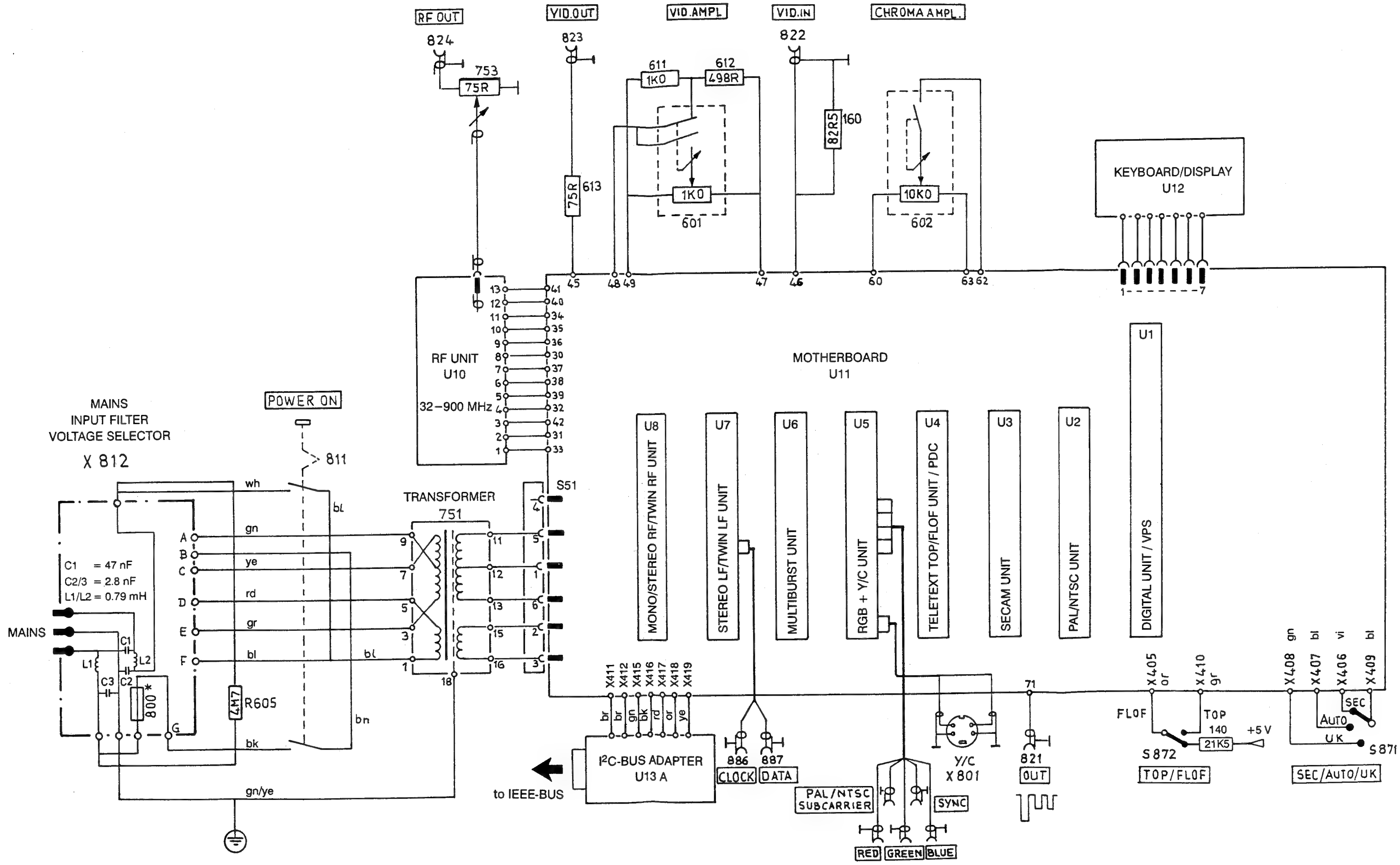


* STEREO OR MONO SOUND
DEPENDING ON VERSION

Fig. 90 Block Diagram

Units		PM 5418 TNSI + Y/C	PM 5418 TNS + Y/C	PM 5418 TNS	PM 5418 TXS + Y/C	PM 5418 TXS	PM 5418 TN + Y/C	PM 5418 TN	PM 5418 TXI + Y/C	PM 5418 TX + Y/C	PM 5418 TX	PM 5418 + Y/C	PM 5418	PM 5415 TNS + Y/C	PM 5415 TNS	PM 5415 TXS + Y/C	PM 5415 TXS	PM 5415 TN + Y/C	PM 5415 TN	PM 5415 TX + Y/C	PM 5415 TX	PM 5415 + Y/C	PM 5415
MOTHERBOARD	U11	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
DIGITAL UNIT	U1						×	×	×	×	×	×	×					×	×	×	×	×	×
DIGITAL UNIT VPS	U1/VPS	×	×	×	×	×								×	×	×	×						
PAL/NTSC UNIT	U2		×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×
PAL/NTSC UNIT TXI/TNSI	U2/IEEE	×							×														
SECAM UNIT	U3		×	×	×	×	×	×		×	×	×	×										
SECAM UNIT TXI/TNSI	U3/IEEE	×							×														
TELETEXT TOP/FLOF	U4						×	×	×	×	×							×	×	×	×		
TELETEXT / PDC / CC	U4/PDC	×	×	×	×	×								×	×	×	×						
RGB + Y/C UNIT	U5	×	×		×		×		×	×		×		×		×		×		×		×	
MULTIBURST	U6		×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×
MULTIBURST TXI/TNSI	U6/IEEE	×							×														
LF STEREO UNIT	U7/ST				×	×			×	×	×					×	×			×	×		
RF STEREO UNIT	U8/ST				×	×			×	×	×					×	×			×	×		
MONO SOUND UNIT	U8											×	×									×	×
TWIN LF UNIT	U7/TWIN	×	×	×			×	×						×	×			×	×				
TWIN RF UNIT	U8/TWIN	×	×	×			×	×						×	×			×	×				
RF UNIT	U10	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
KEYBOARD UNIT	U12				×	×			×	×	×	×	×			×	×			×	×	×	×
KEYBOARD UNIT NICAM	U12/N	×	×	×			×	×						×	×			×	×				
IEEE–BUS UNIT	U13	×							×														
I^2C–BUS ADAPTER	U13 A	×							×														

Fig. 100 Survey of Units and Versions



★ 315 mAT FOR MAINS VOLTAGE 220 V~/240 V~
630 mAT FOR MAINS VOLTAGE 110 V~/120 V~

Fig. 101 Overall Circuit Diagram

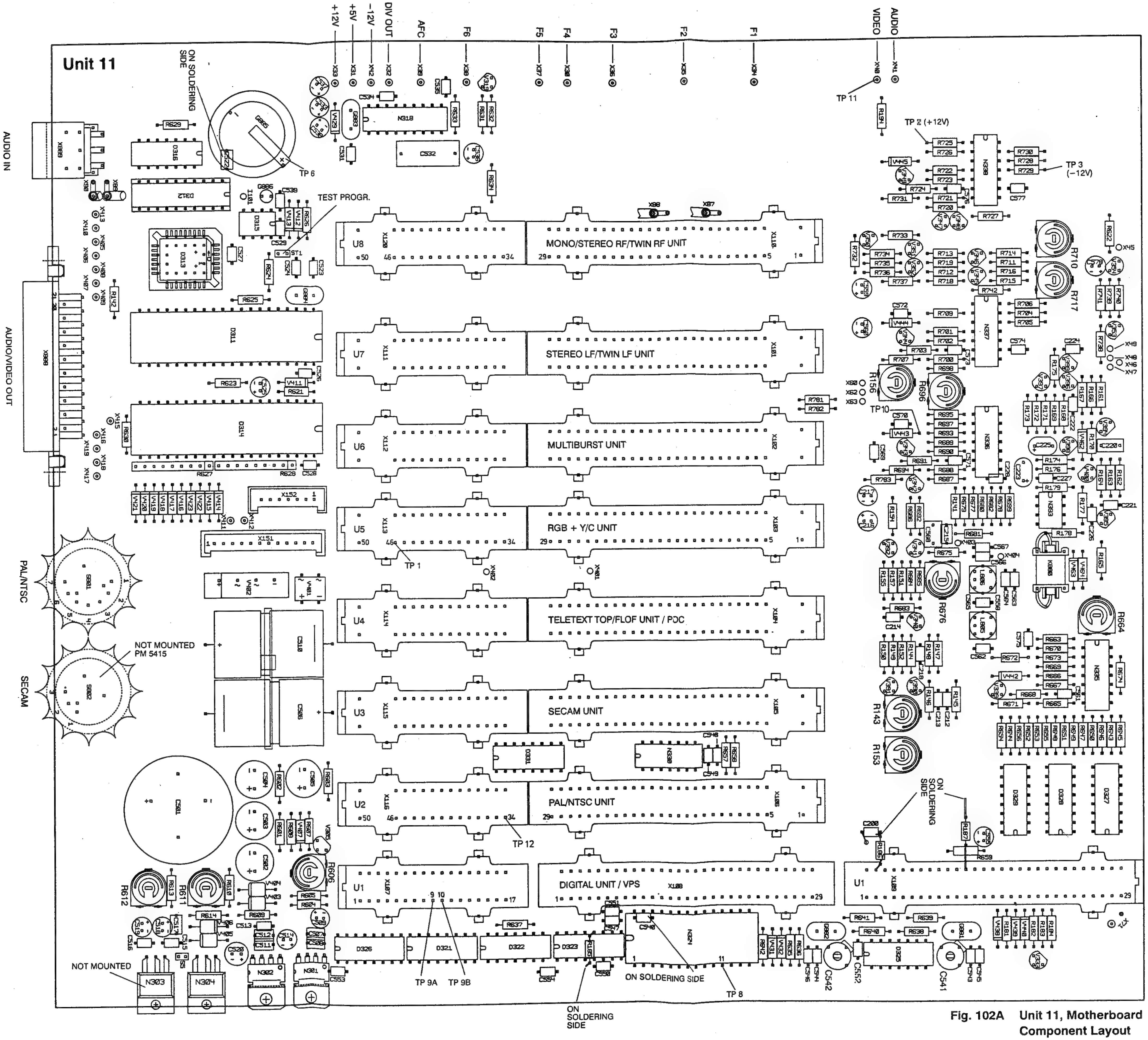


Fig. 102A Unit 11, Motherboard Component Layout

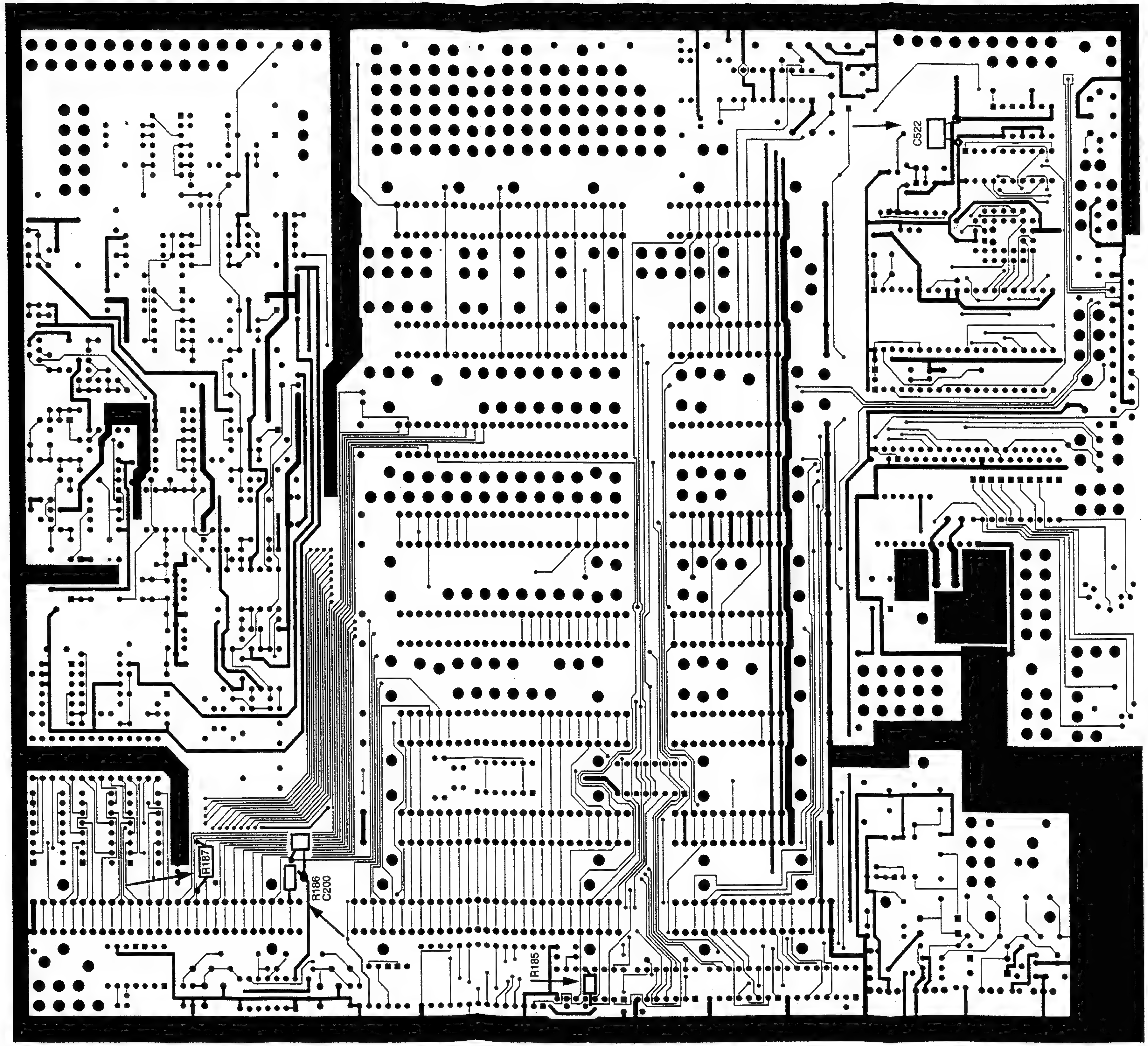
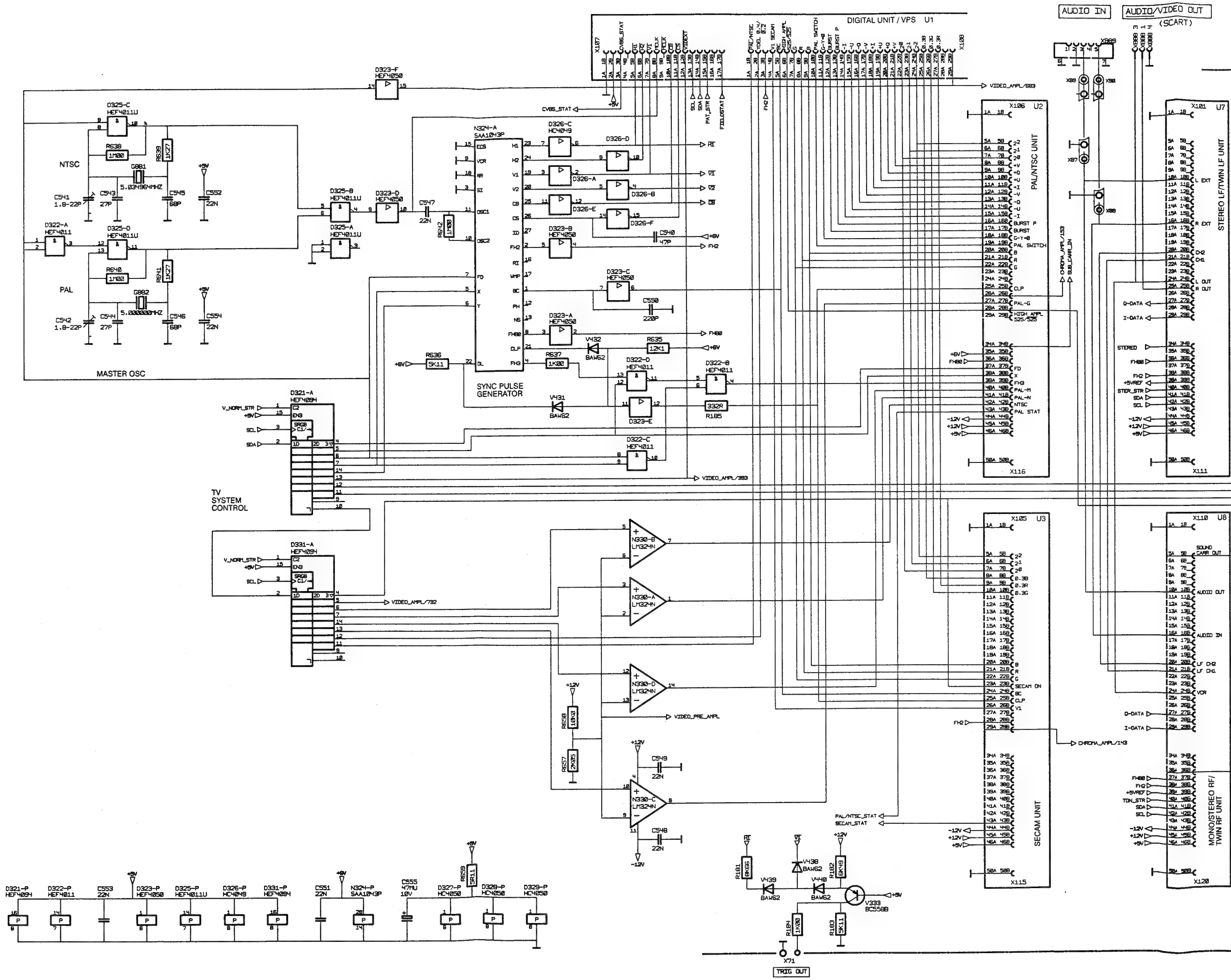


Fig. 102B Unit 11, Motherboard, Soldering Side


DIGITAL UNIT / VPS U1
AUDIO IN
AUDIO/VIDEO OUT
(SCART)
MASTER OSC
NTSC
PAL
SYNC PULSE
GENERATOR
TV
SYSTEM
CONTROL
PAL/NTSC UNIT
STEREO LF/TWIN LF UNIT
SECAM UNIT
MONO/STEREO RF/
TWIN RF UNIT
TRIG OUT
N324-A
SAA1043P
D321-A
HEF4094
D331-A
HEF4094
N330-A
LM324N
N330-B
LM324N
N330-C
LM324N
N330-D
LM324N
V333
BC558B
VIDEO_AMPL/683
VIDEO_AMPL/393
VIDEO_AMPL/792
VIDEO_PRE_AMPL
CHROMA_AMPL/143
G801
5.034964MHZ
G802
5.000000MHZ
X106 U2
X101 U7
X105 U3
X110 U8
X116
X111
X115
X120
X71

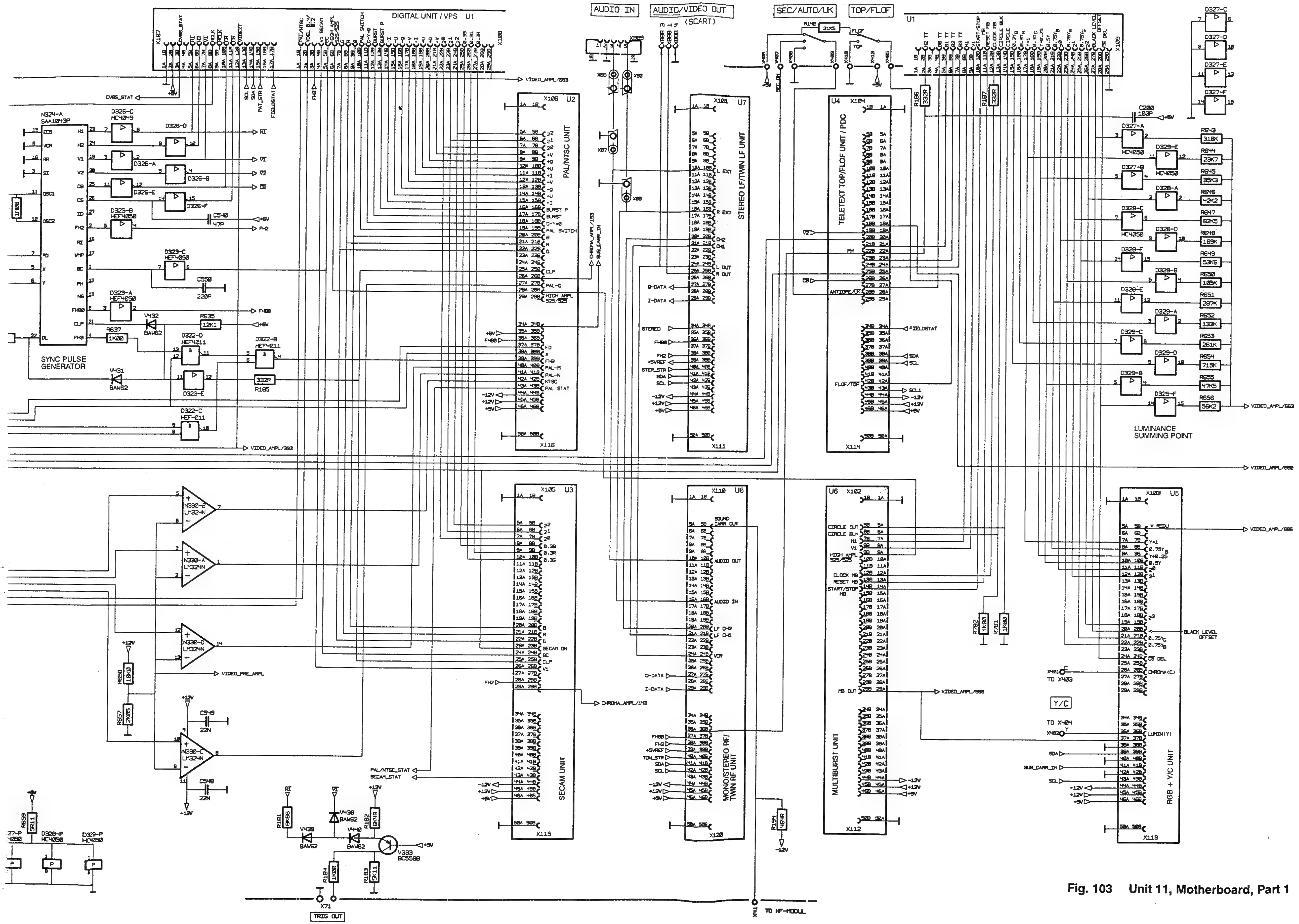


Fig. 103 Unit 11, Motherboard, Part 1

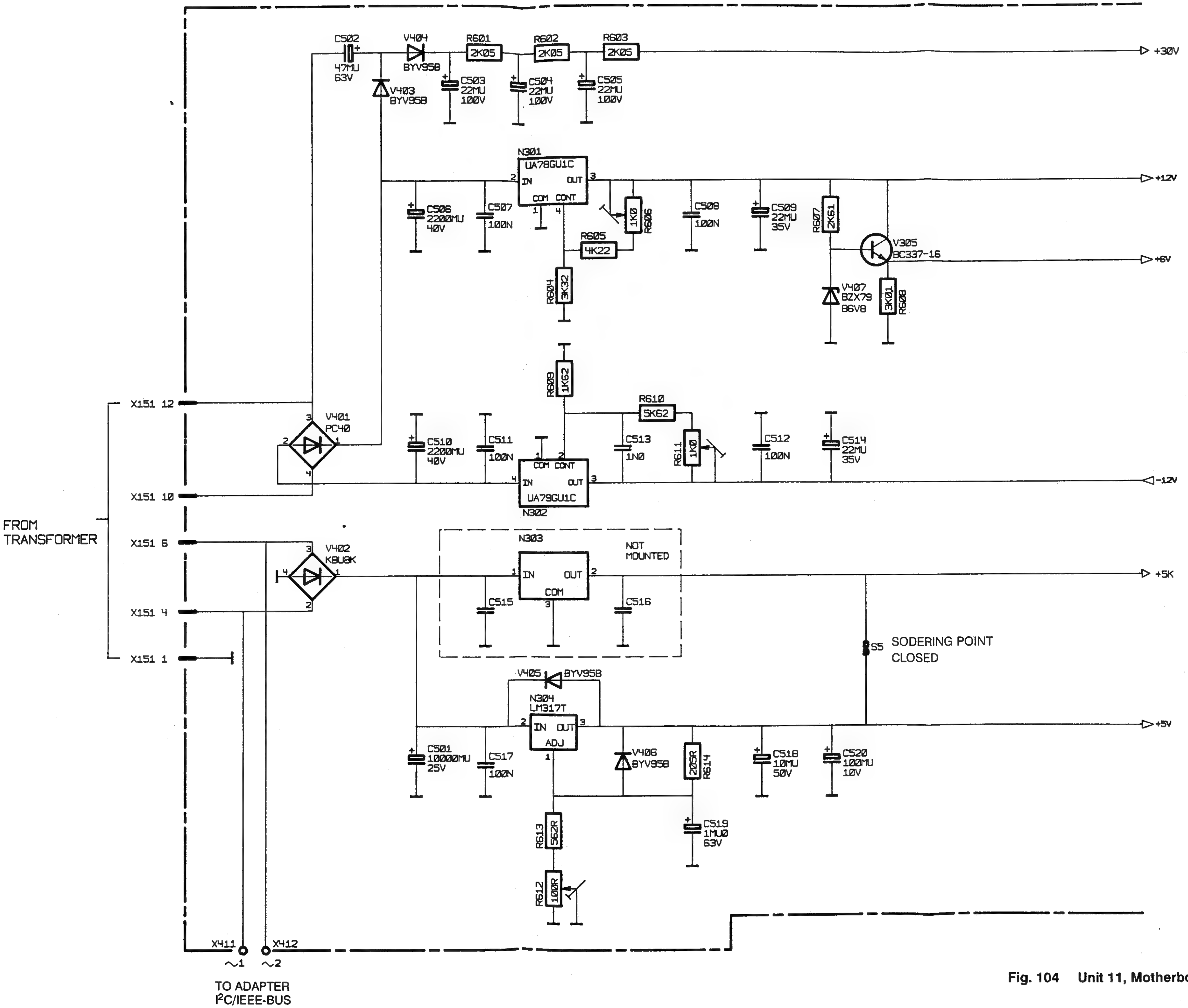


Fig. 104 Unit 11, Motherboard, Part 2

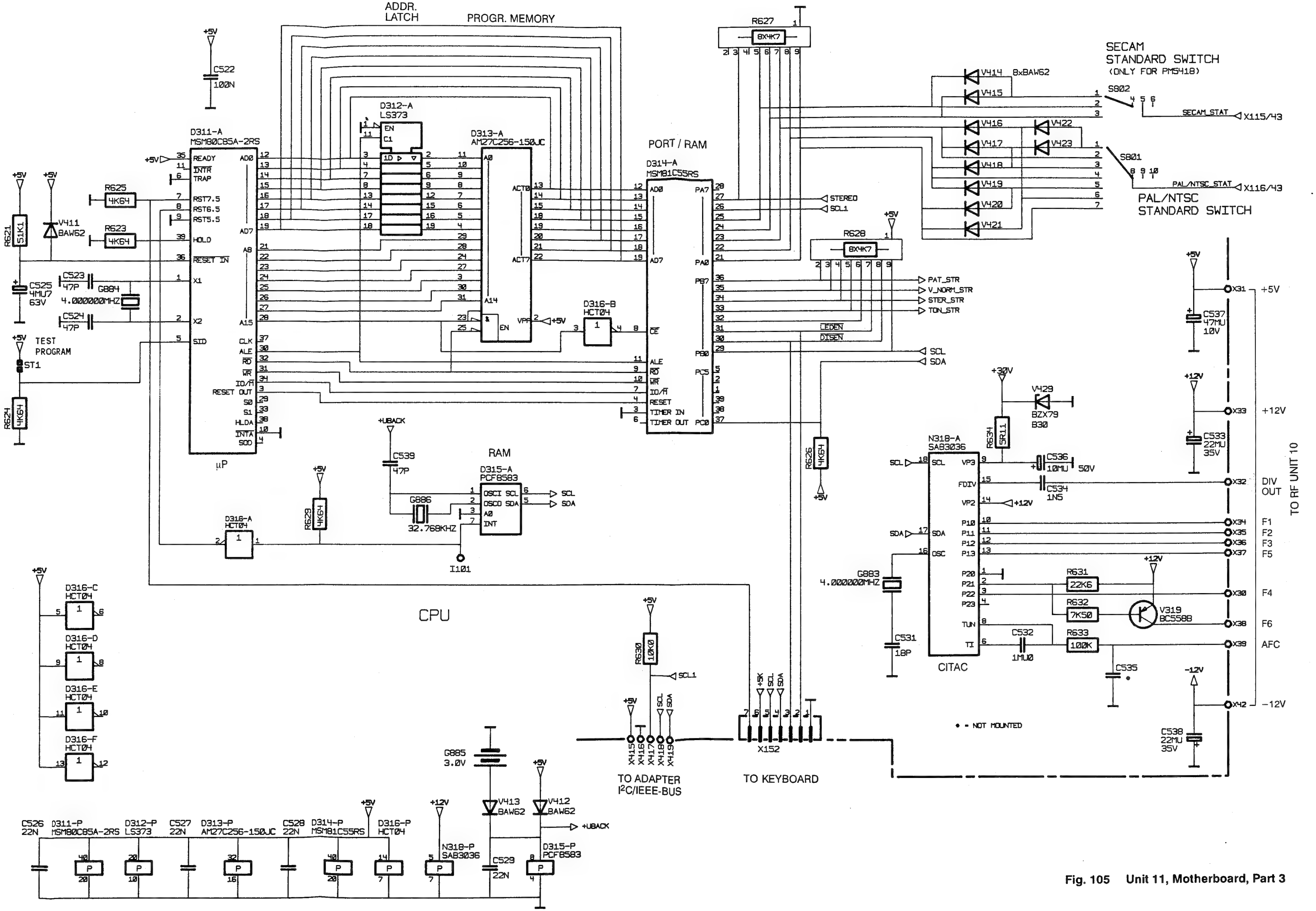
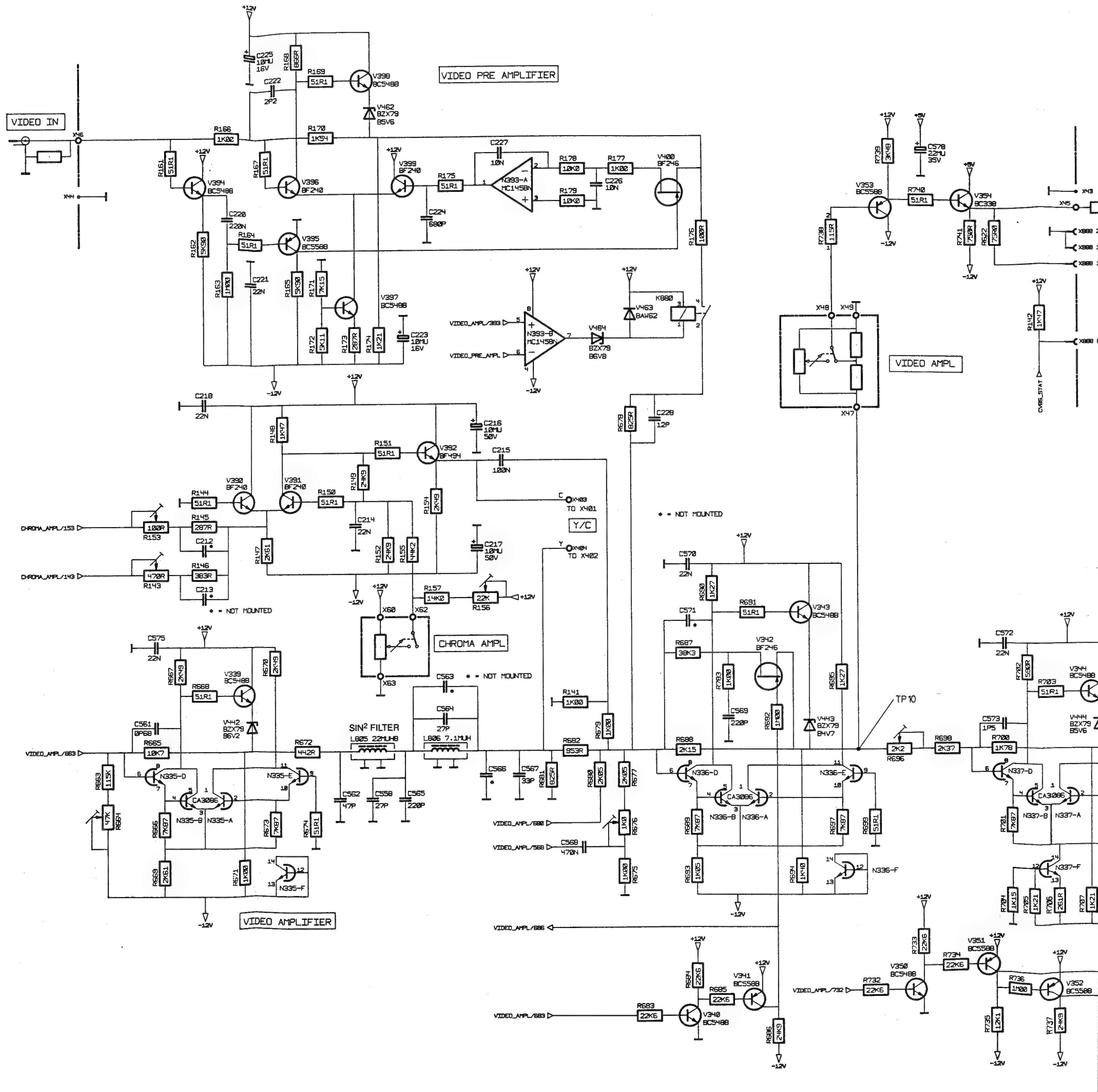


Fig. 105 Unit 11, Motherboard, Part 3


VIDEO PRE AMPLIFIER
VIDEO IN
VIDEO AMPL
CHROMA AMPL
Y/C
TO X401
TO X402
SIN² FILTER
VIDEO AMPLIFIER
• = NOT MOUNTED
TP10
VIDEO_AMPL/383
VIDEO_PRE_AMPL
CHROMA_AMPL/153
CHROMA_AMPL/143
VIDEO_AMPL/663
VIDEO_AMPL/680
VIDEO_AMPL/568
VIDEO_AMPL/686
VIDEO_AMPL/683
VIDEO_AMPL/732

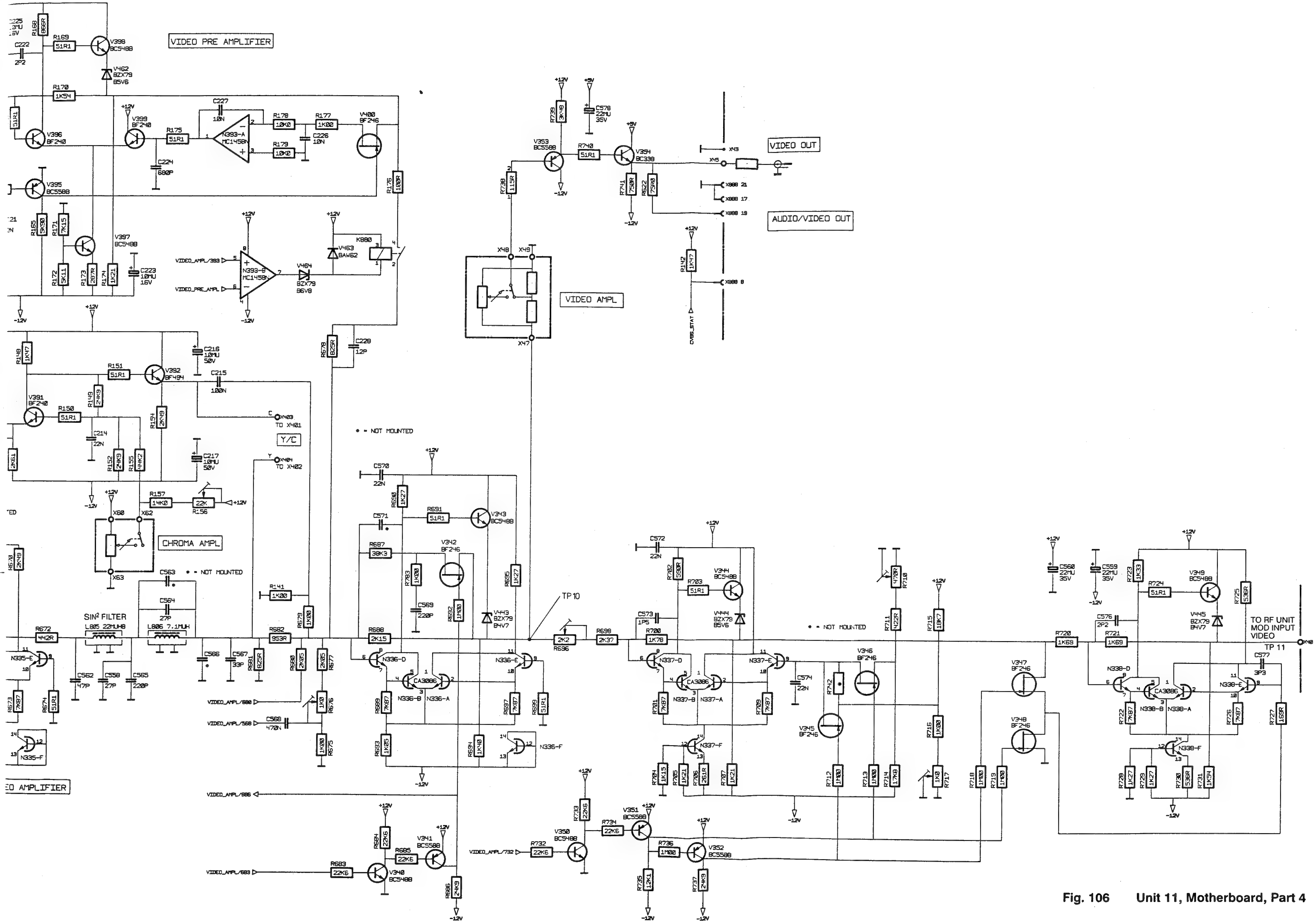
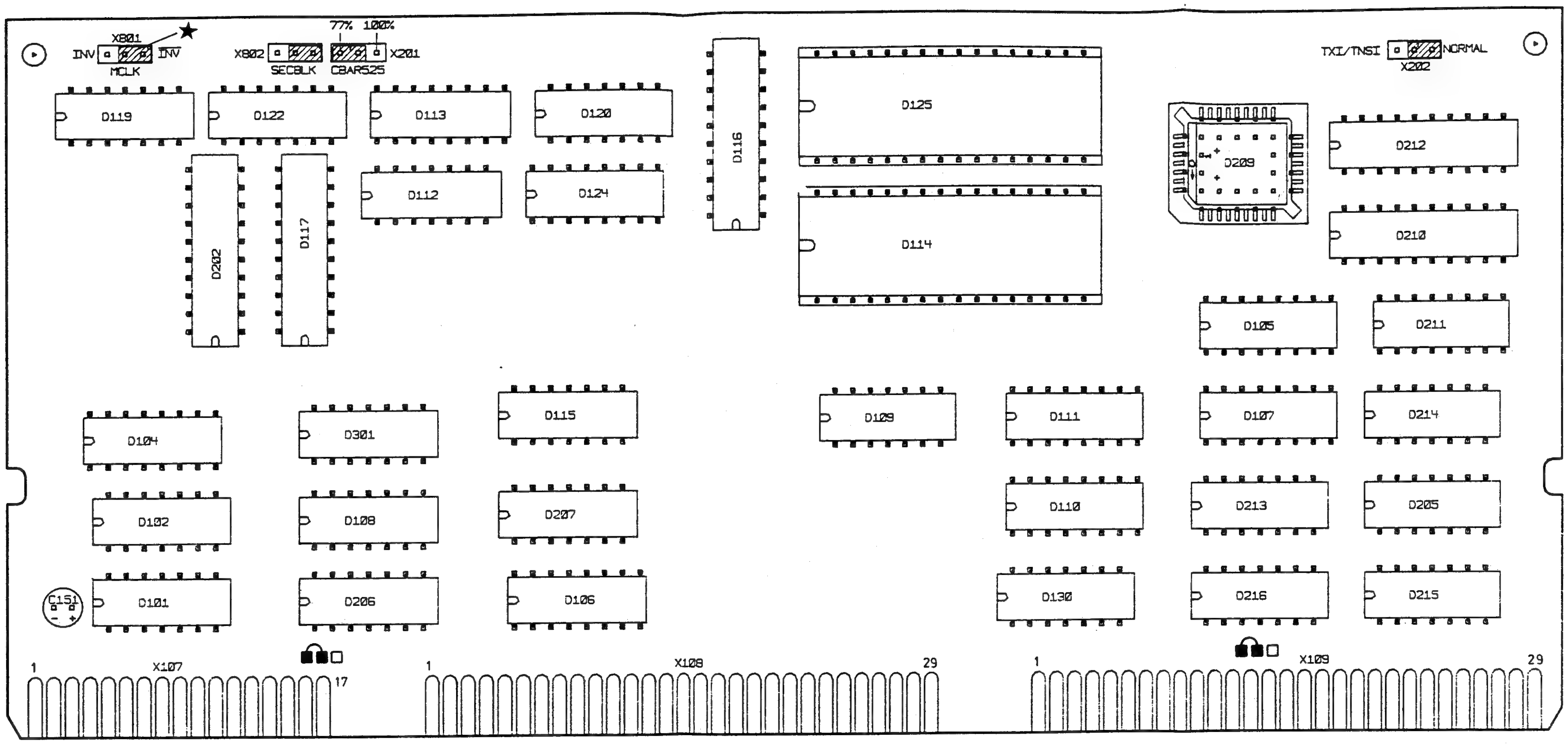


Fig. 106 Unit 11, Motherboard, Part 4



★ Jumper setting depends on MCLK selection

Fig. 107 **Unit 1, Digital Unit 16:9, Component Layout 1**

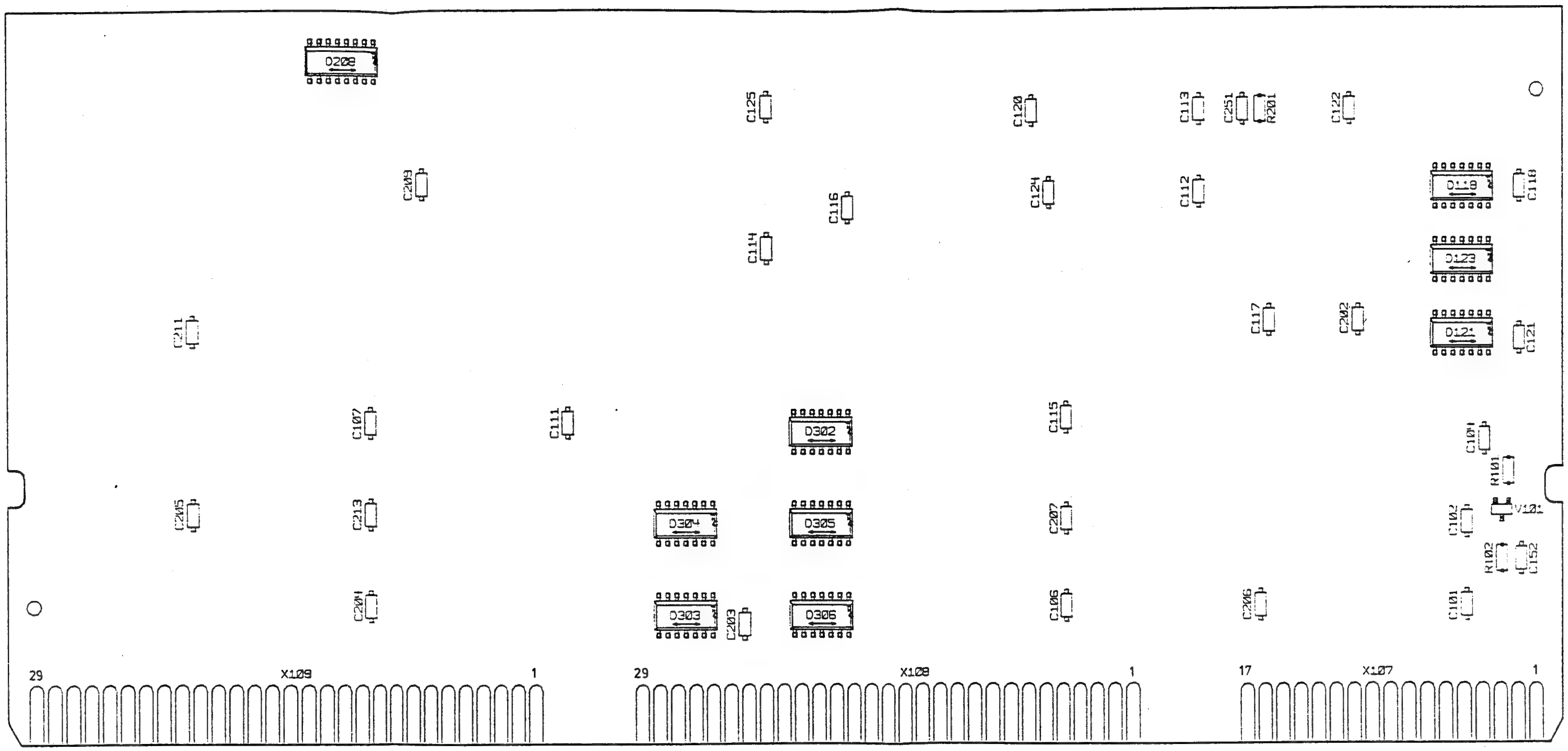
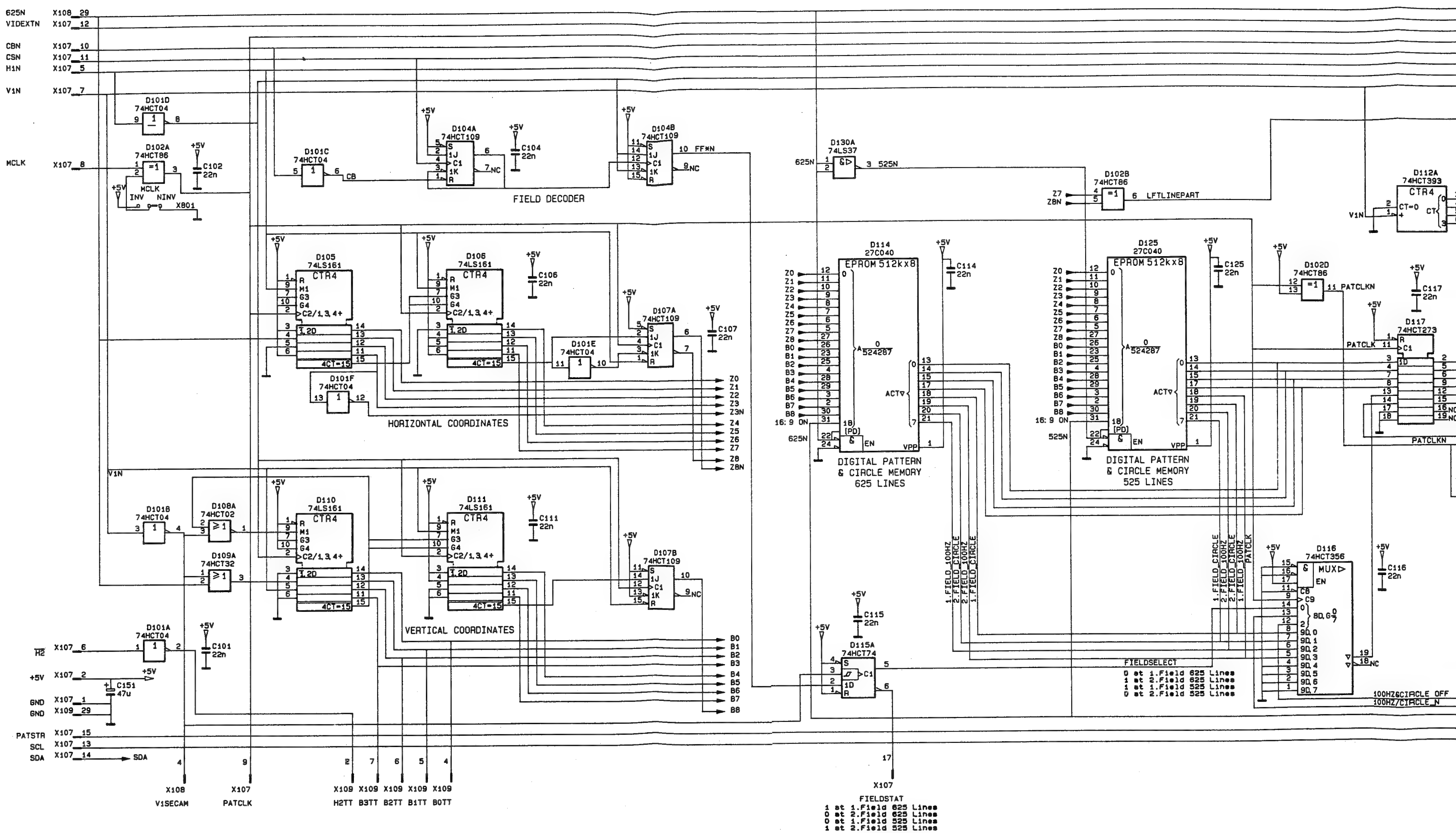


Fig. 108 Unit 1, Digital Unit 16:9, Component Layout 2



625N X108 29
VIDEXTN X107 12
CBN X107 10
CSN X107 11
H1N X107 5
V1N X107 7
MCLK X107 8
D101D 74HCT04
D102A 74HCT86
MCLK INV NINV X801
D101C 74HCT04
D104A 74HCT109
D104B 74HCT109
FF*N
FIELD DECODER
D130A 74LS37
625N
525N
D102B 74HCT86
LFTLINEPART
D112A 74HCT393
D105 74LS161
D106 74LS161
D107A 74HCT109
D101E 74HCT04
D101F 74HCT04
HORIZONTAL COORDINATES
D114 27C040
EPROM 512kx8
D125 27C040
DIGITAL PATTERN & CIRCLE MEMORY 625 LINES
DIGITAL PATTERN & CIRCLE MEMORY 525 LINES
D102D 74HCT86
PATCLKN
D117 74HCT273
PATCLK
D101B 74HCT04
D108A 74HCT02
D109A 74HCT32
D110 74LS161
D111 74LS161
D107B 74HCT109
VERTICAL COORDINATES
D101A 74HCT04
H2 X107 6
+5V X107 2
C151 47u
GND X107 1
GND X109 29
PATSTR X107 15
SCL X107 13
SDA X107 14 SDA
D115A 74HCT74
D116 74HCT356
MUX
1.FIELD 100HZ
2.FIELD CIRCLE
2.FIELD 100HZ
1.FIELD CIRCLE
FIELDSELECT
0 at 1.Field 625 Lines
1 at 2.Field 625 Lines
1 at 1.Field 525 Lines
0 at 2.Field 525 Lines
100HZ&CIRCLE OFF
100HZ/CIRCLE N
X108 V1SECAM
X107 PATCLK
X109 H2TT
X109 B3TT
X109 B2TT
X109 B1TT
X109 B0TT
X107
FIELDSTAT
1 at 1.Field 625 Lines
0 at 2.Field 625 Lines
0 at 1.Field 525 Lines
1 at 2.Field 525 Lines

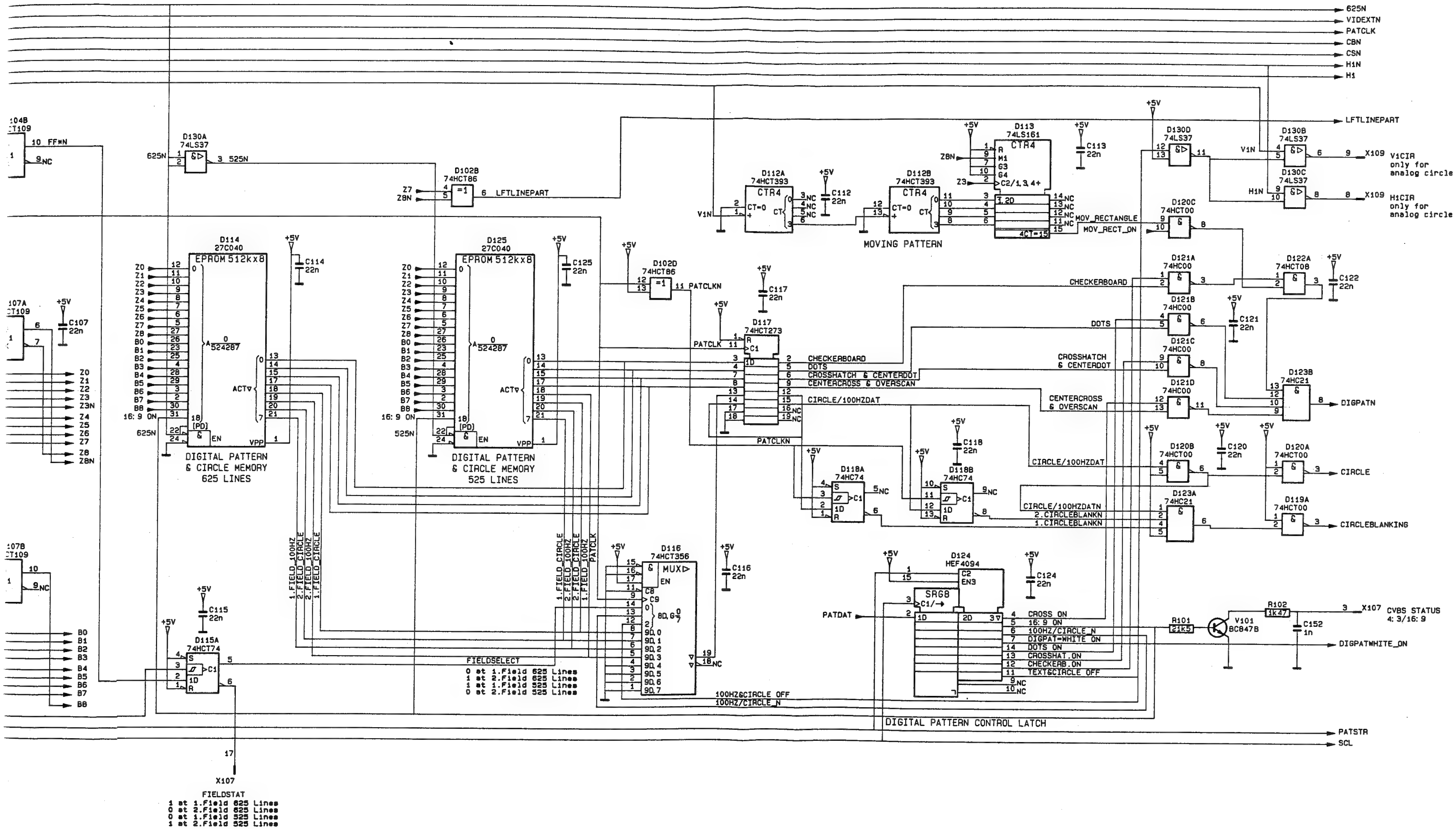
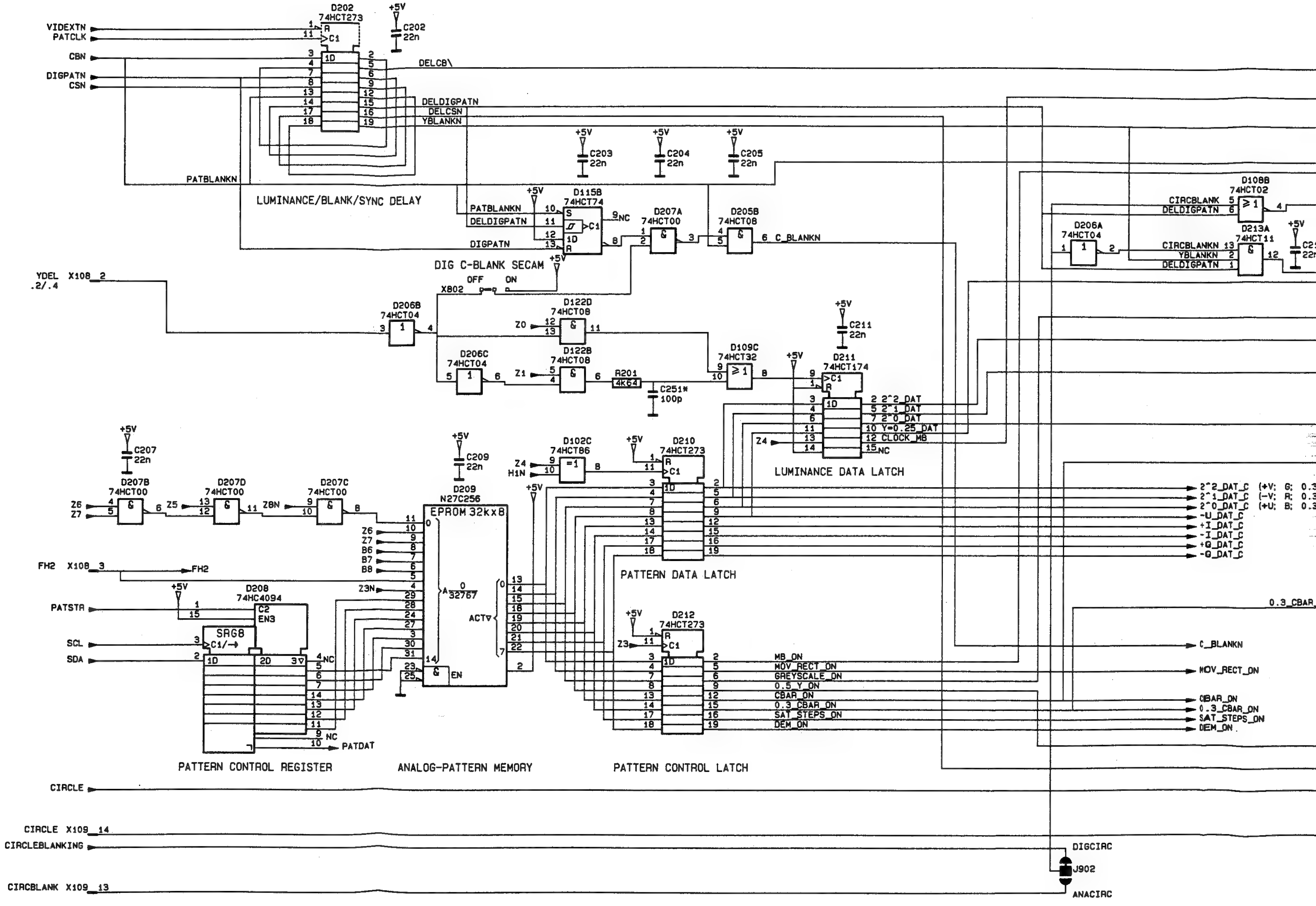


Fig. 109 Unit 1, Digital Unit 16:9, Part 1



D202
74HCT273
VIDEXTN
PATCLK
CBN
DIGPATN
CSN
DELCB\
DELDIGPATN
DELCSN
YBLANKN
PATBLANKN
LUMINANCE/BLANK/SYNC DELAY
D115B
74HCT74
D207A
74HCT00
D205B
74HCT08
C_BLANKN
DIG C-BLANK SECAM
X802
OFF
ON
YDEL X108_2
.2/.4
D206B
74HCT04
D122D
74HCT08
D122B
74HCT08
D206C
74HCT04
R201
4K64
C251*
100p
D109C
74HCT32
D211
74HCT174
2^2_DAT
2^1_DAT
2^0_DAT
Y=0.25_DAT
CLOCK_MB
LUMINANCE DATA LATCH
D207B
74HCT00
D207D
74HCT00
D207C
74HCT00
D209
N27C256
EPROM 32kx8
D102C
74HCT86
D210
74HCT273
PATTERN DATA LATCH
2^2_DAT_C
2^1_DAT_C
2^0_DAT_C
-U_DAT_C
+I_DAT_C
-I_DAT_C
+Q_DAT_C
-Q_DAT_C
FH2 X108_3
PATSTR
SCL
SDA
D208
74HC4094
SRG8
PATDAT
PATTERN CONTROL REGISTER
ANALOG-PATTERN MEMORY
D212
74HCT273
MB_ON
MOV_RECT_ON
GREYSCALE_ON
0.5_Y_ON
CBAR_ON
0.3_CBAR_ON
SAT_STEPS_ON
DEM_ON
PATTERN CONTROL LATCH
D108B
74HCT02
CIRCBLANK
D206A
74HCT04
D213A
74HCT11
CIRCBLANKN
0.3_CBAR
C_BLANKN
MOV_RECT_ON
CBAR_ON
0.3_CBAR_ON
SAT_STEPS_ON
DEM_ON
CIRCLE
CIRCLE X109_14
CIRCLEBLANKING
CIRCBLANK X109_13
DIGCIRC
J902
ANACIRC

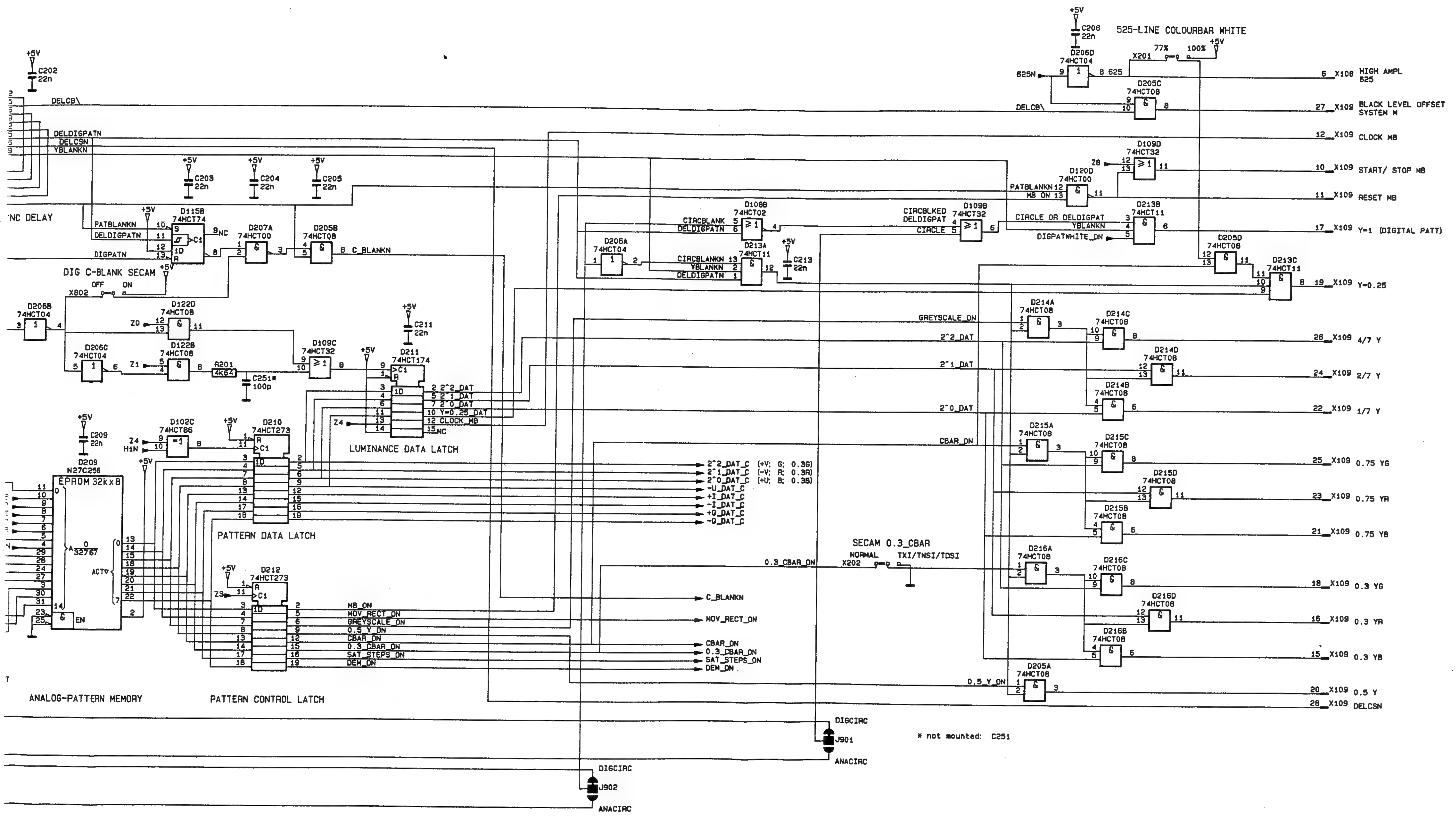


Fig. 110 Unit 1, Digital Unit 16:9, Part 2

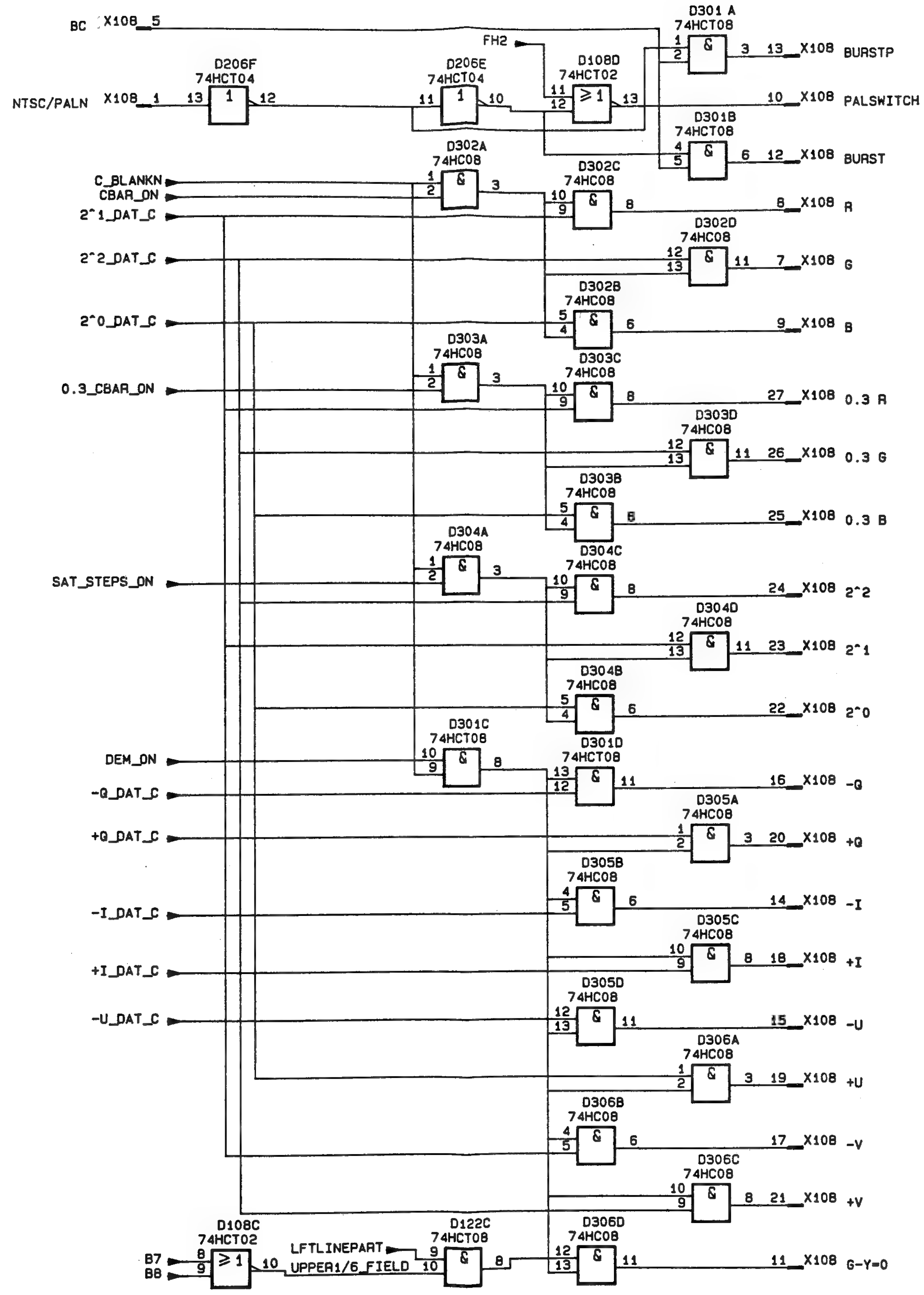


Fig. 111 Unit 1, Digital Unit 16:9, Part 3

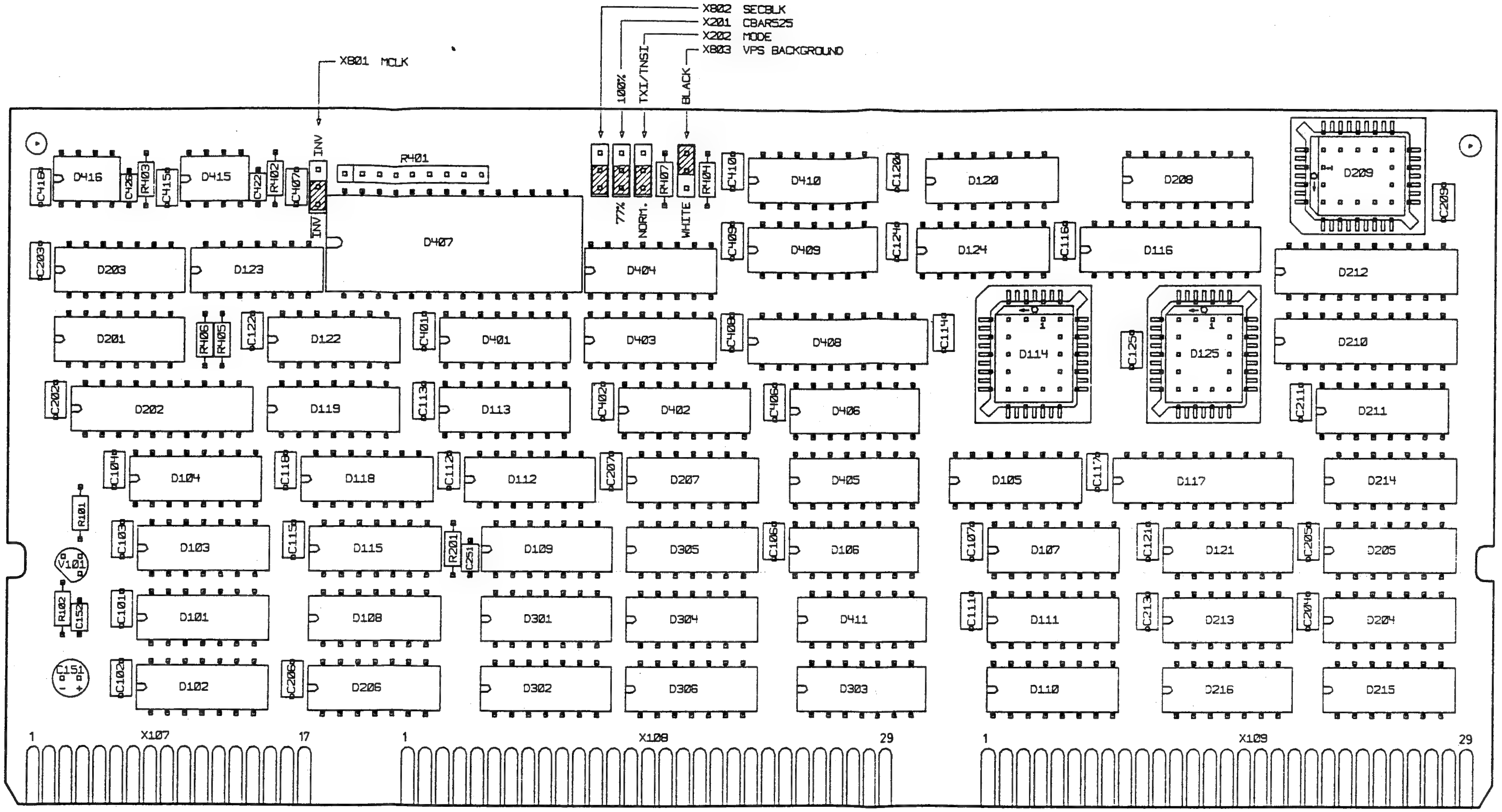
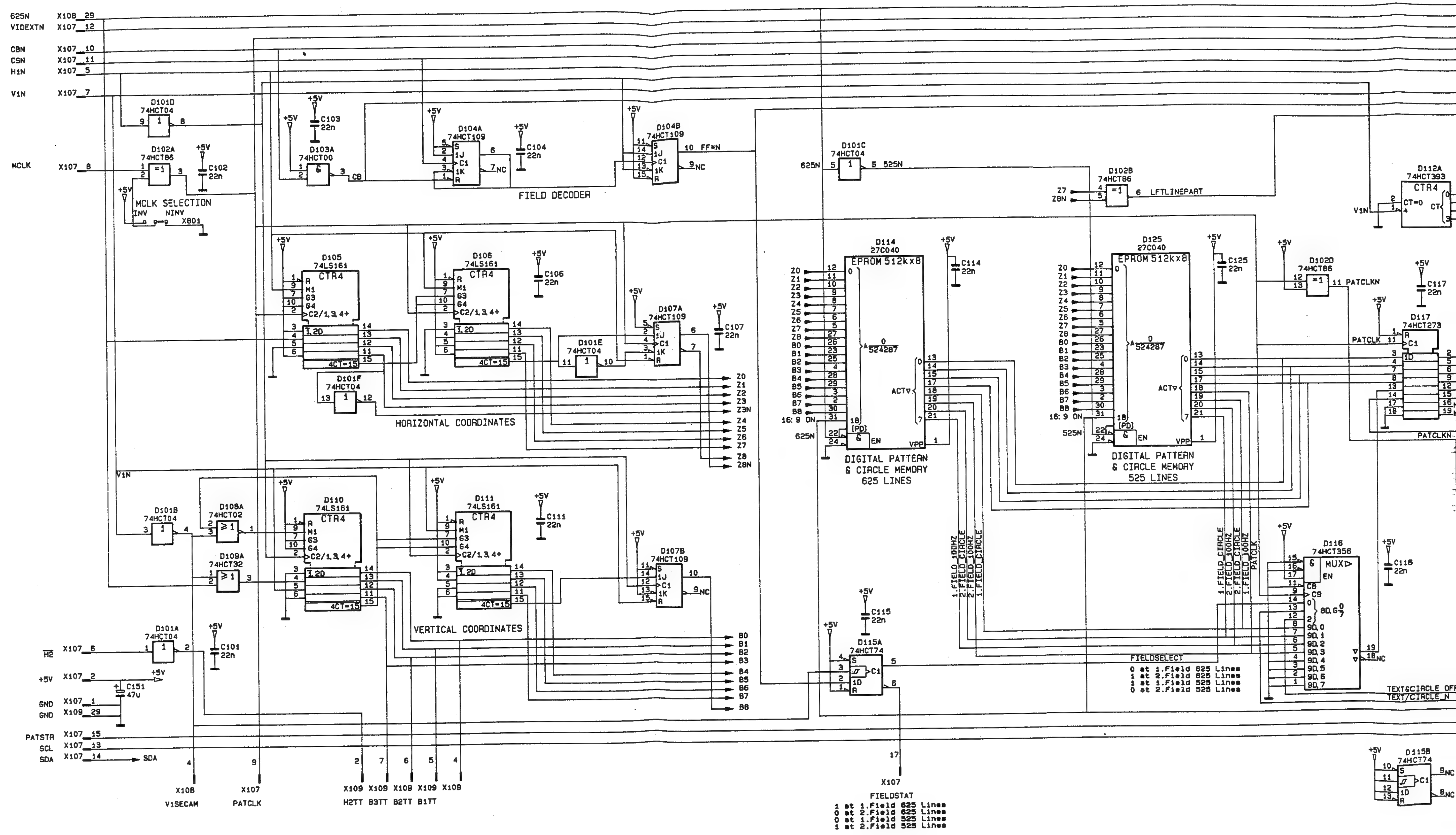


Fig. 112 Unit 1, Digital Unit 16:9/VPS, Component Layout


625N X108 29
VIDEXTN X107 12
CBN X107 10
CSN X107 11
H1N X107 5
V1N X107 7
MCLK X107 8
MCLK SELECTION
INV NINV X801
FIELD DECODER
FF*N
625N 525N
LFTLINEPART
D101D 74HCT04
D102A 74HCT86
D103A 74HCT00
D104A 74HCT109
D104B 74HCT109
D101C 74HCT04
D102B 74HCT86
D112A 74HCT393
D105 74LS161
D106 74LS161
D107A 74HCT109
D101E 74HCT04
D101F 74HCT04
HORIZONTAL COORDINATES
D114 27C040
EPROM 512kx8
DIGITAL PATTERN & CIRCLE MEMORY 625 LINES
D125 27C040
DIGITAL PATTERN & CIRCLE MEMORY 525 LINES
D102D 74HCT86
PATCLKN
D117 74HCT273
D101B 74HCT04
D108A 74HCT02
D109A 74HCT32
D110 74LS161
D111 74LS161
D107B 74HCT109
VERTICAL COORDINATES
D101A 74HCT04
D115A 74HCT74
D116 74HCT356
D115B 74HCT74
1.FIELD 100HZ
2.FIELD CIRCLE
2.FIELD 100HZ
1.FIELD CIRCLE
PATCLK
FIELDSELECT
0 at 1.Field 625 Lines
1 at 2.Field 625 Lines
1 at 1.Field 525 Lines
0 at 2.Field 525 Lines
TEXT&CIRCLE OFF
TEXT/CIRCLE_N
H2 X107 6
+5V X107 2
GND X107 1
GND X109 29
PATSTR X107 15
SCL X107 13
SDA X107 14
X108 V1SECAM
X107 PATCLK
X109 H2TT
X109 B3TT
X109 B2TT
X109 B1TT
X107
FIELDSTAT
1 at 1.Field 625 Lines
0 at 2.Field 625 Lines
0 at 1.Field 525 Lines
1 at 2.Field 525 Lines

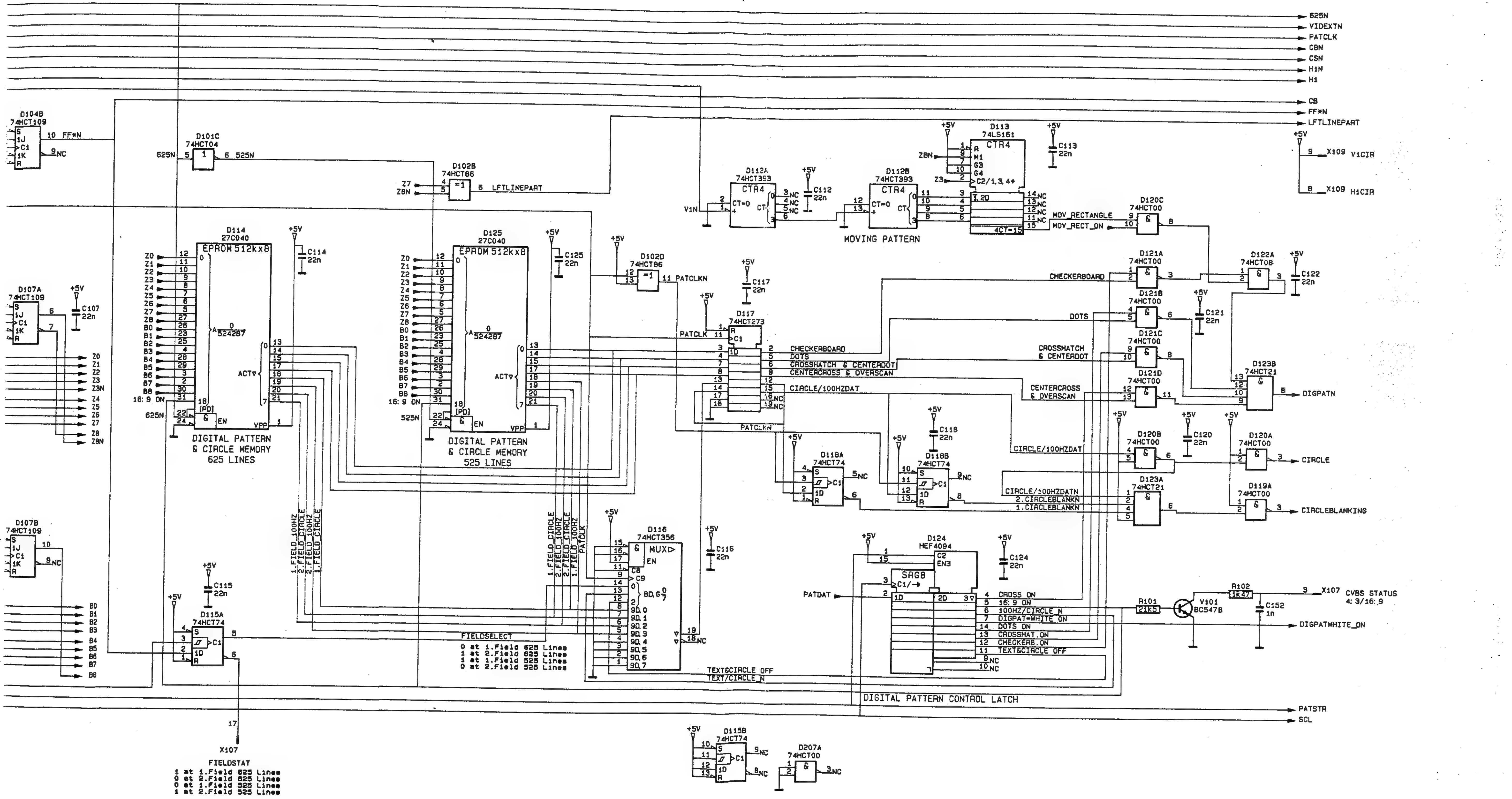
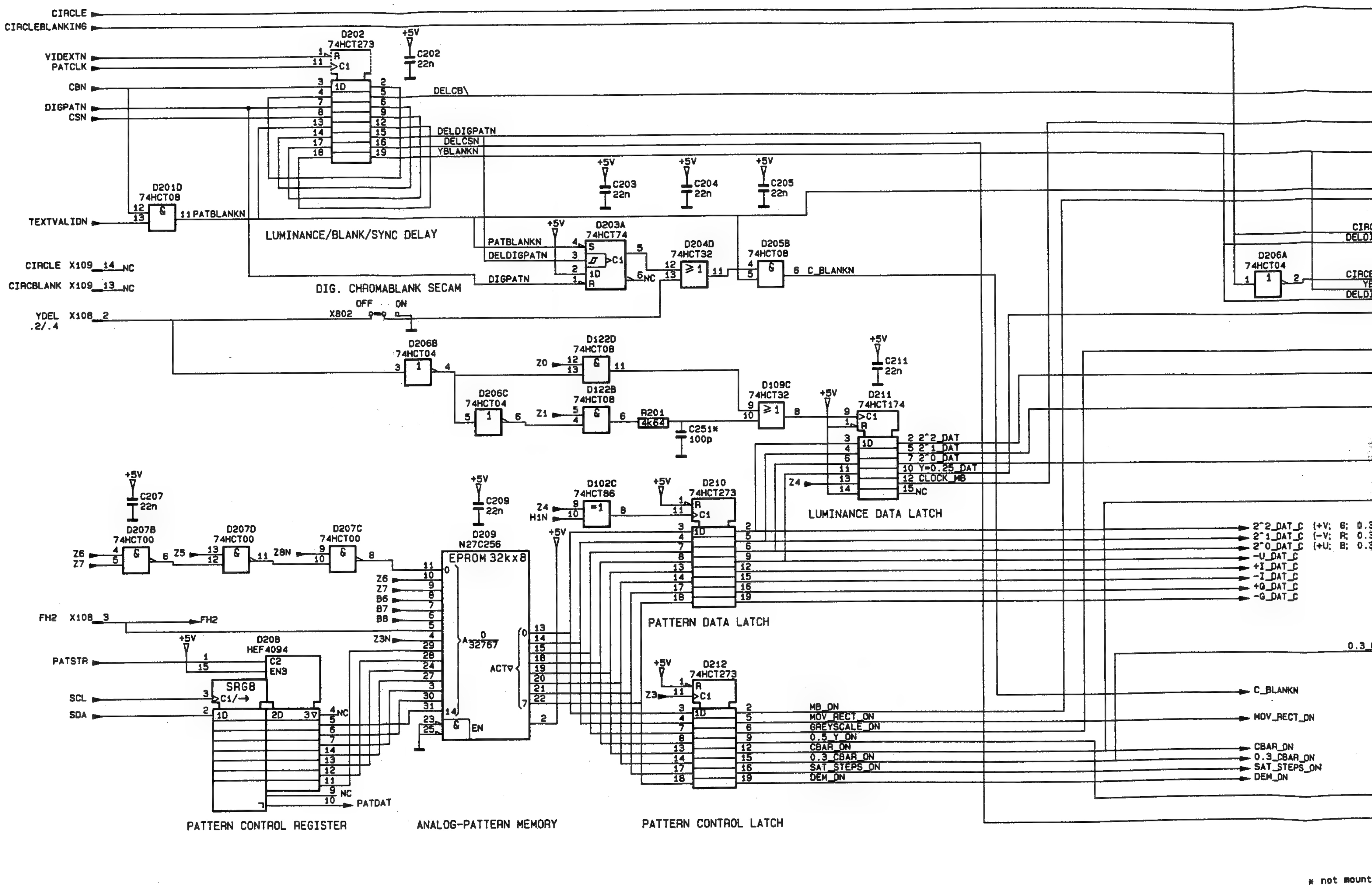
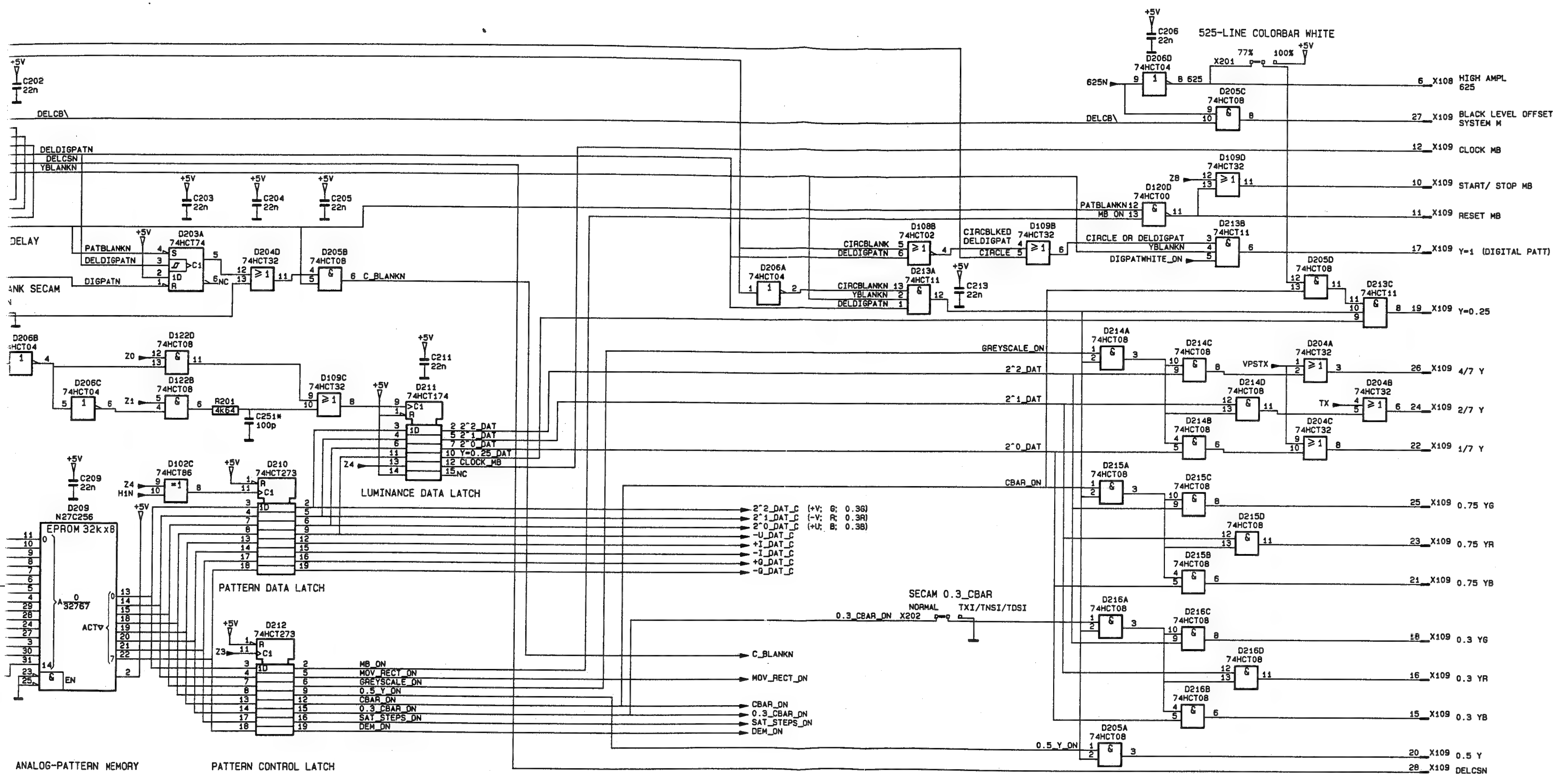


Fig. 113 Unit 1, Digital Unit 16:9/VPS, Part 1


CIRCLE
CIRCLEBLANKING
VIDEXTN
PATCLK
CBN
DIGPATN
CSN
D202
74HCT273
DELCB\
DELDIGPATN
DELCSN
YBLANKN
TEXTVALIDN
D201D
74HCT08
PATBLANKN
LUMINANCE/BLANK/SYNC DELAY
D203A
74HCT74
D204D
74HCT32
D205B
74HCT08
C_BLANKN
D206A
74HCT04
CIRCLE X109 14 NC
CIRCBLANK X109 13 NC
DIG. CHROMABLANK SECAM
YDEL X108 2
.2/.4
X802
OFF ON
D206B
74HCT04
D122D
74HCT08
D206C
74HCT04
D122B
74HCT08
R201
4K64
C251*
100p
D109C
74HCT32
D211
74HCT174
2^2_DAT
2^1_DAT
2^0_DAT
Y=0.25_DAT
CLOCK_MB
LUMINANCE DATA LATCH
D207B
74HCT00
D207D
74HCT00
D207C
74HCT00
D209
N27C256
EPROM 32kx8
D102C
74HCT86
D210
74HCT273
PATTERN DATA LATCH
2^2_DAT_C
2^1_DAT_C
2^0_DAT_C
-U_DAT_C
+I_DAT_C
-I_DAT_C
+Q_DAT_C
-G_DAT_C
FH2 X108 3
PATSTR
SCL
SDA
D208
HEF4094
SRG8
PATDAT
D212
74HCT273
MB_ON
MOV_RECT_ON
GREYSCALE_ON
0.5_Y_ON
CBAR_ON
0.3_CBAR_ON
SAT_STEPS_ON
DEM_ON
C_BLANKN
MOV_RECT_ON
CBAR_ON
0.3_CBAR_ON
SAT_STEPS_ON
DEM_ON
PATTERN CONTROL REGISTER
ANALOG-PATTERN MEMORY
PATTERN CONTROL LATCH
* not mount



* not mounted: C251

Fig. 114 Unit 1, Digital Unit 16:9/VPS, Part 2

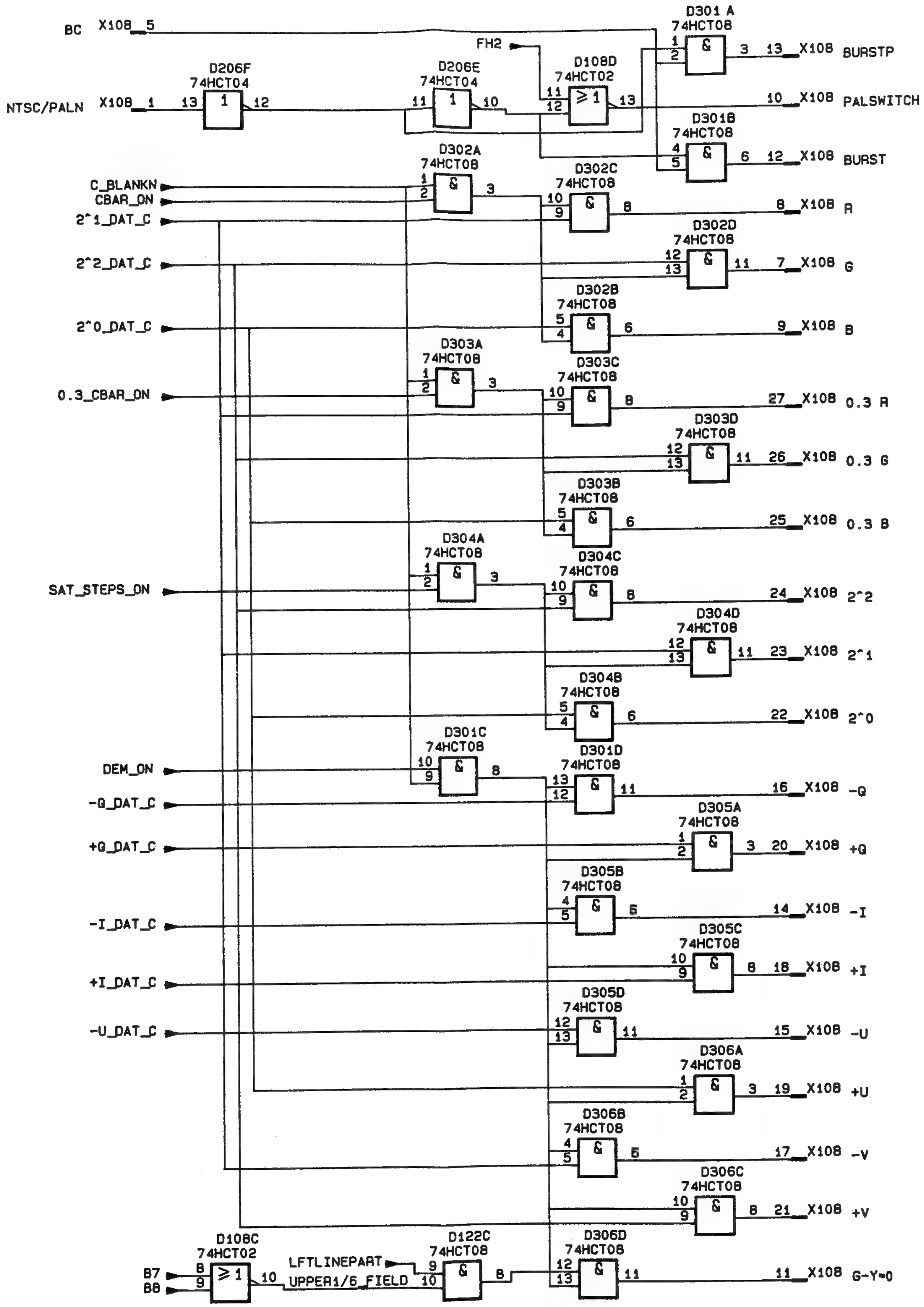
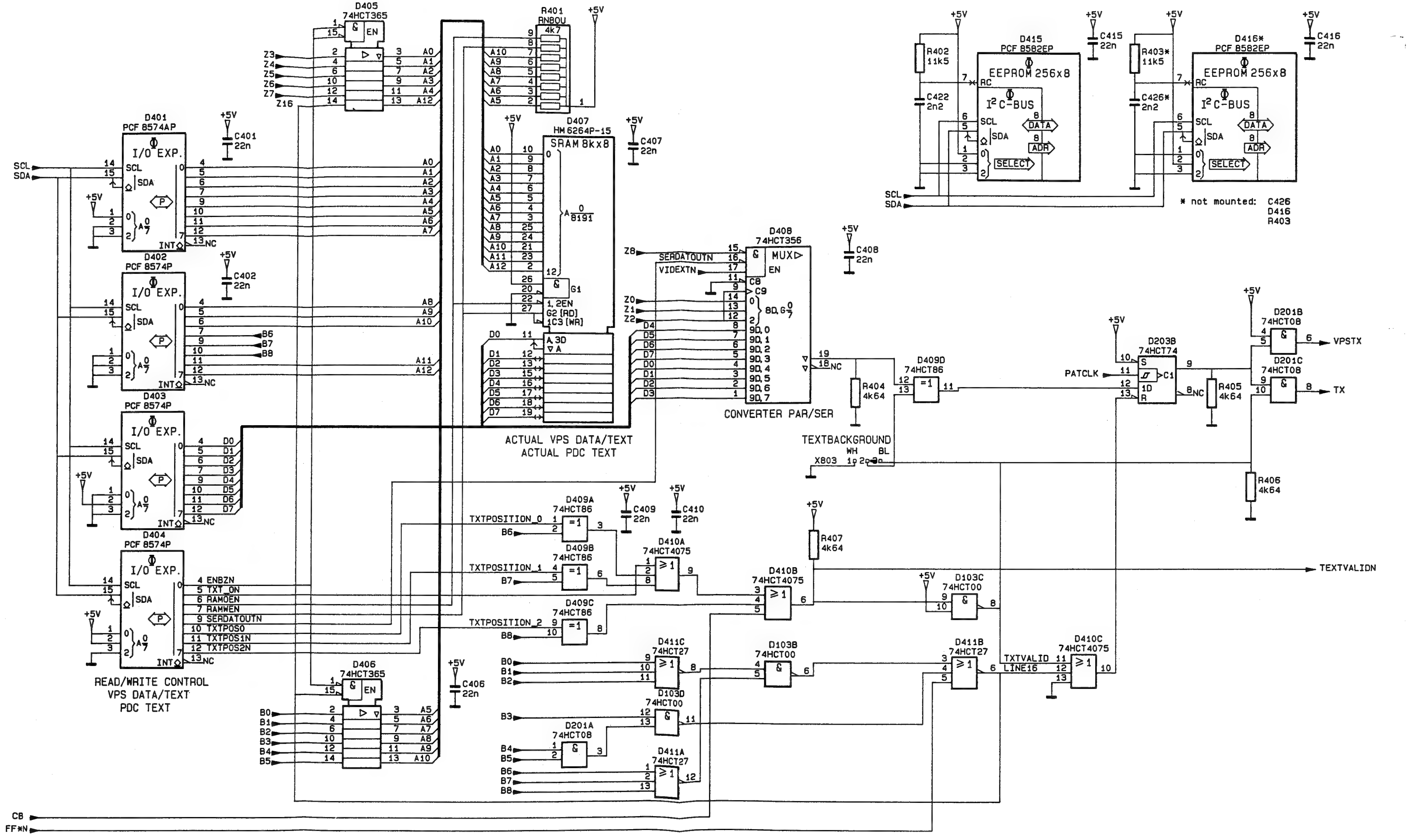
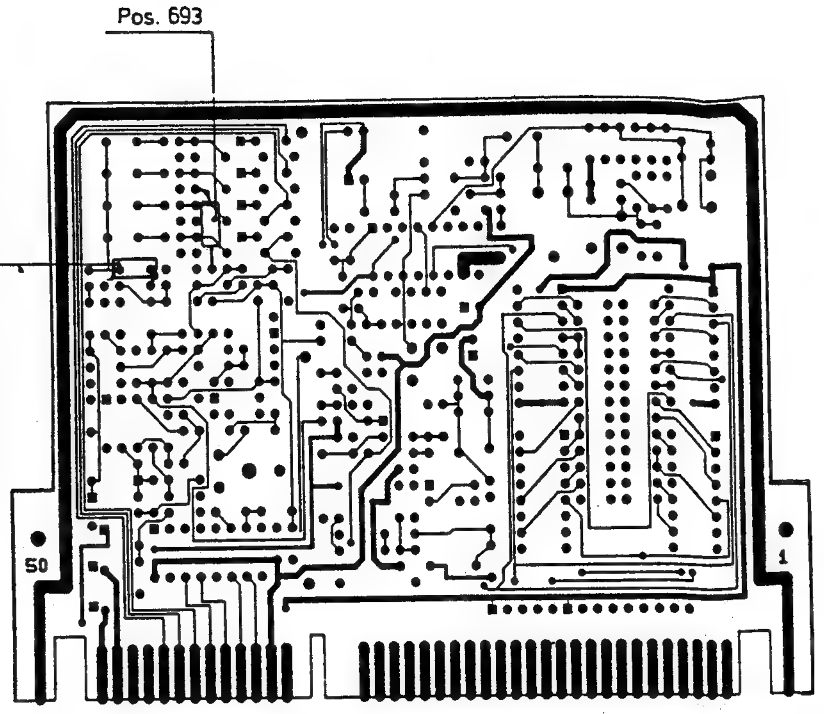


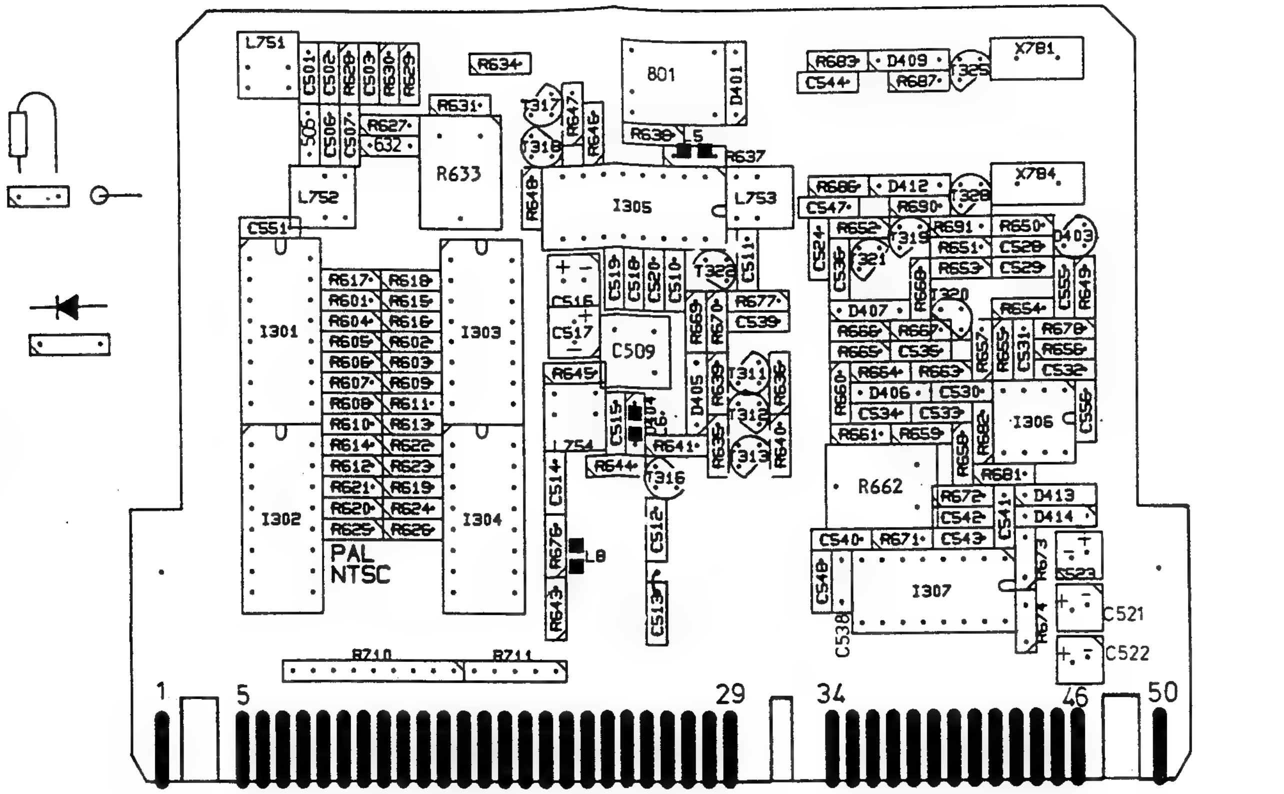
Fig. 115 Unit 1, Digital Unit 16:9/VPS, Part 3

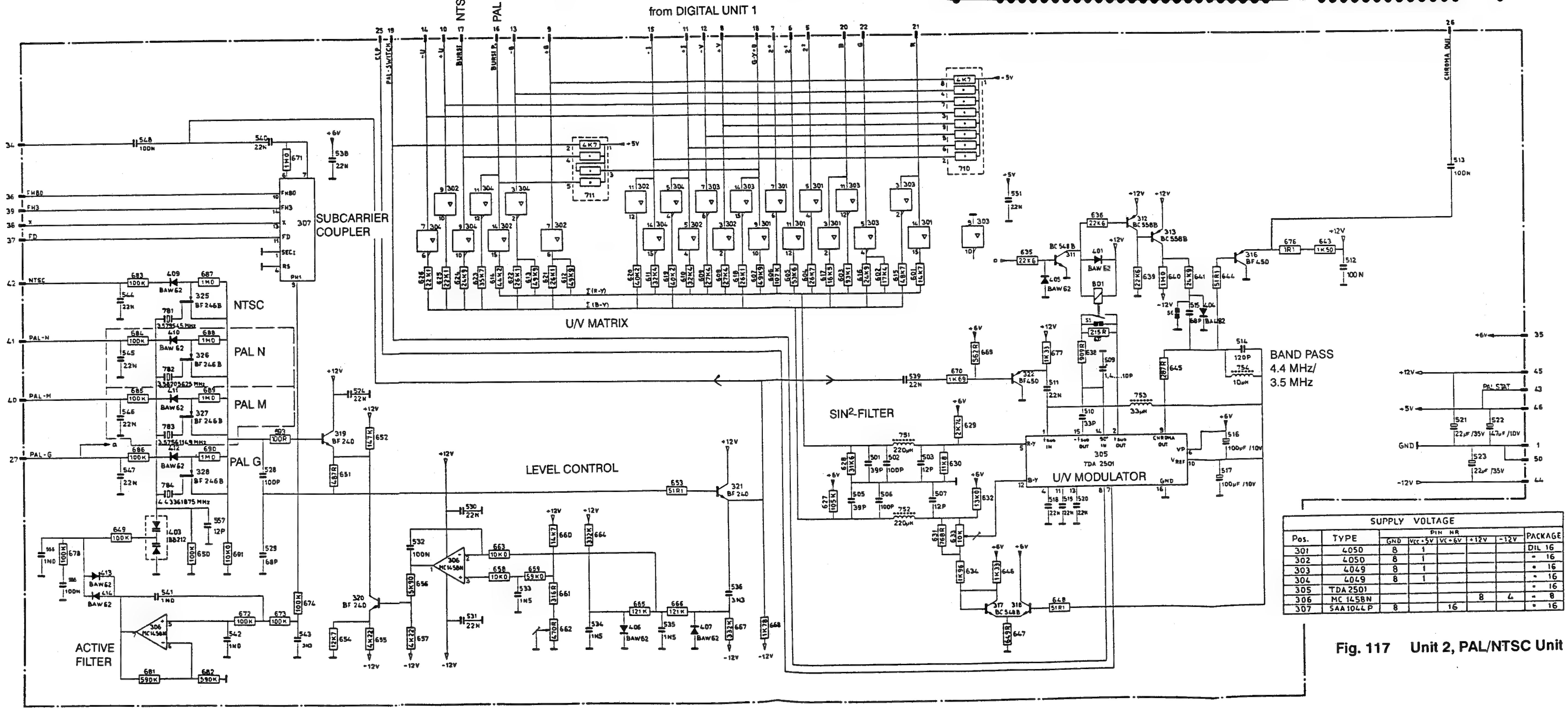


D401 ADDR: 72H
D402 ADDR: 40H
D403 ADDR: 44H
D404 ADDR: 46H

Fig. 116 Unit 1, Digital Unit 16:9/VPS, Part 4







SUPPLY VOLTAGE							
Pos.	TYPE	PIN NR					PACKAGE
		GND	Vcc +5V	VC +6V	+12V	-12V	
301	4050	8	1				DIL 16
302	4050	8	1				• 16
303	4049	8	1				• 16
304	4049	8	1				• 16
305	TDA 2501						• 16
306	MC 1458N				8	4	• 8
307	SAA 1044 P	8		16			• 16

Fig. 117 Unit 2, PAL/NTSC Unit

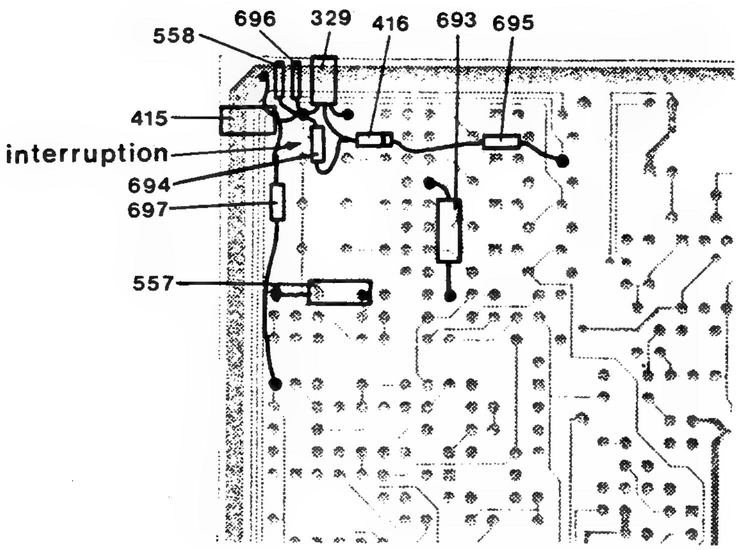


Fig. 118 Unit 2/IEEE, PAL/NTSC Unit, Modifications Wiring Side

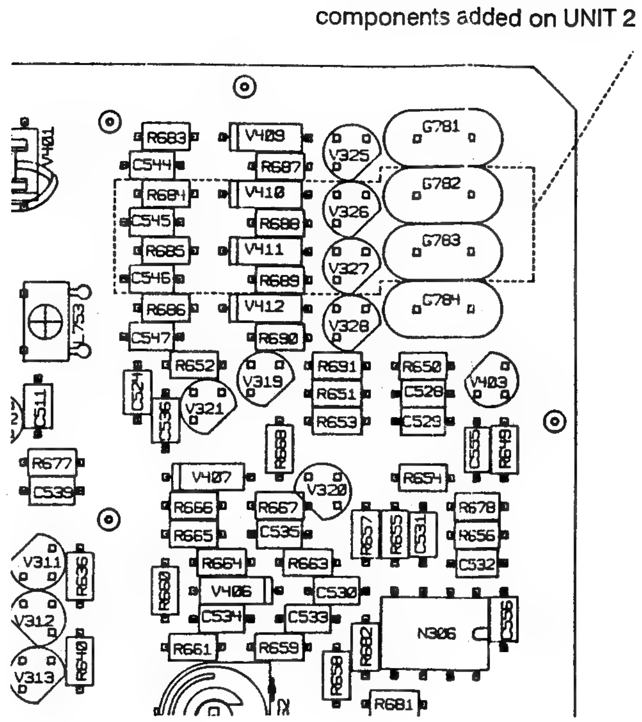


Fig. 119 Unit 2/IEEE, PAL/NTSC Unit, Modifications

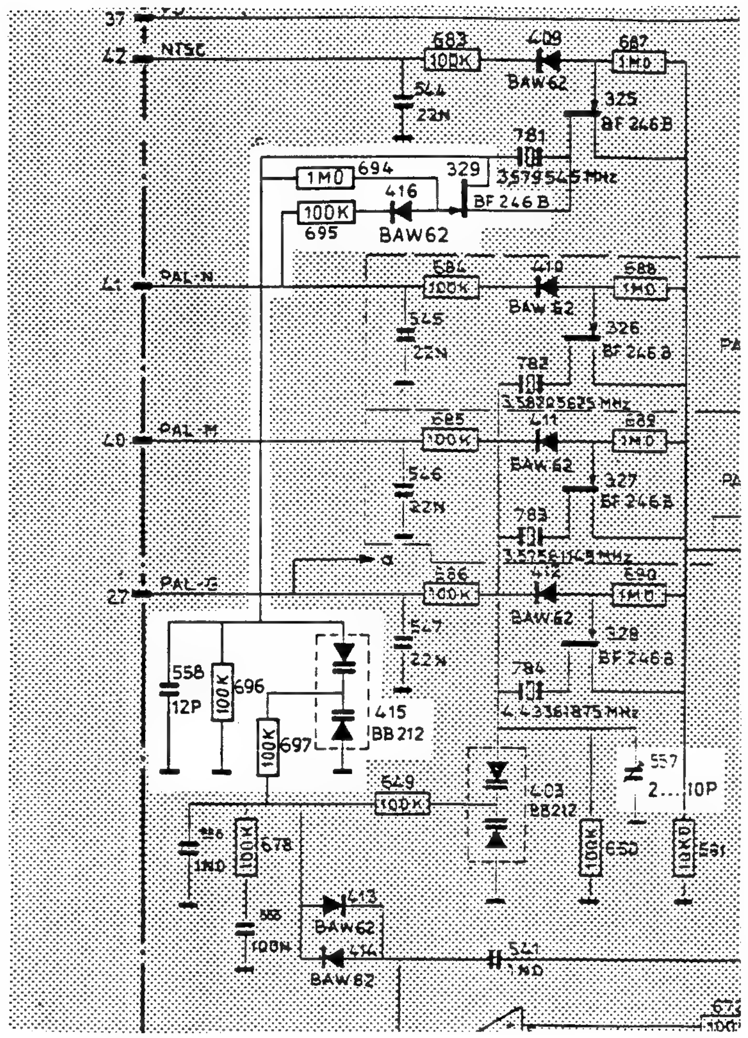
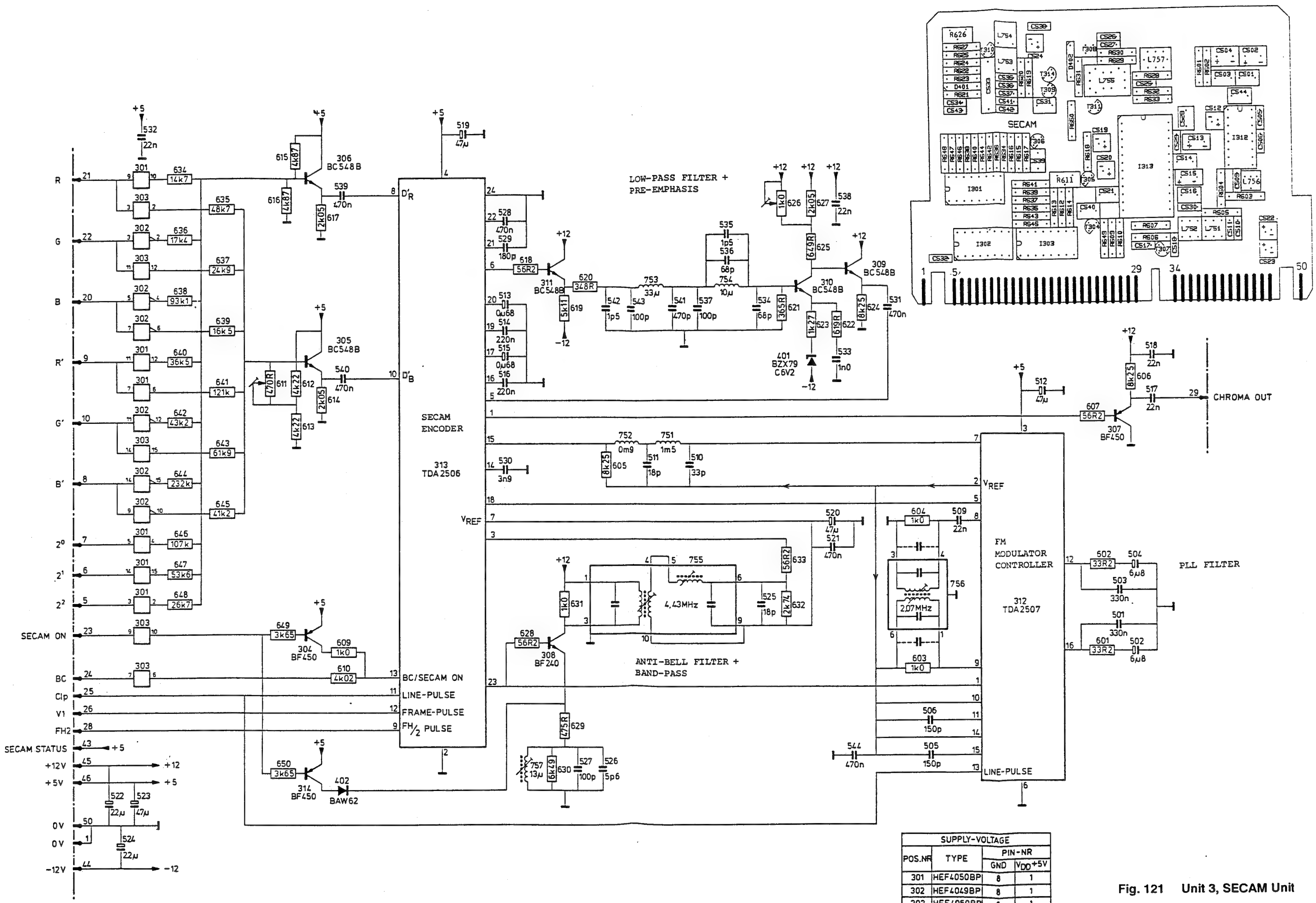
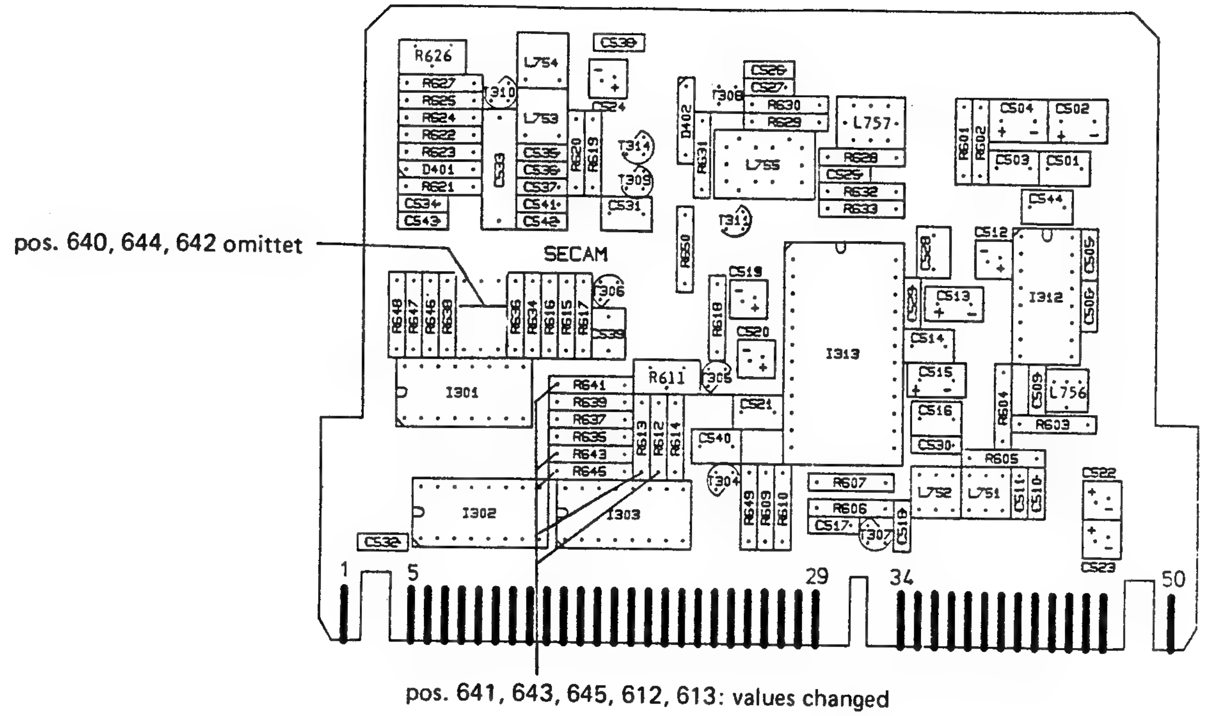


Fig. 120 Unit 2/IEEE, PAL/NTSC Unit, Modifications



SUPPLY-VOLTAGE			
POS.NR	TYPE	PIN-NR	
		GND	VDD +5V
301	HEF4050BP	8	1
302	HEF4049BP	8	1
303	HEF4050BP	8	1

Fig. 121 Unit 3, SECAM Unit



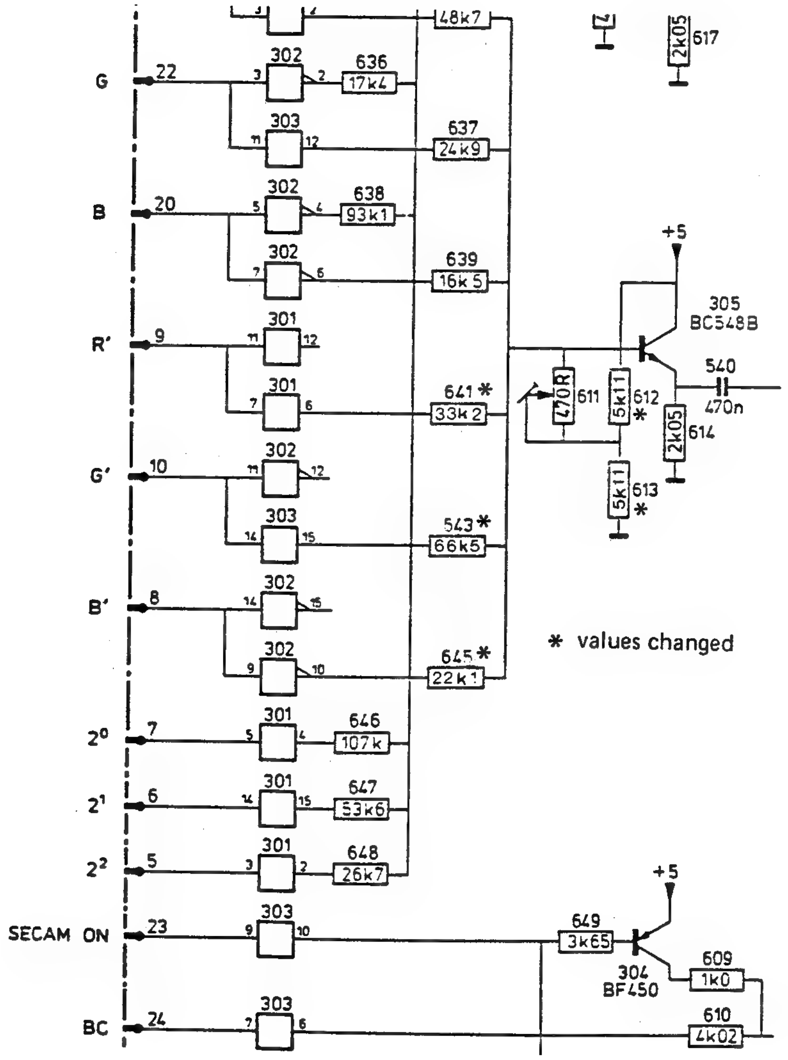


Fig. 122 Unit 3/IEEE, SECAM Unit

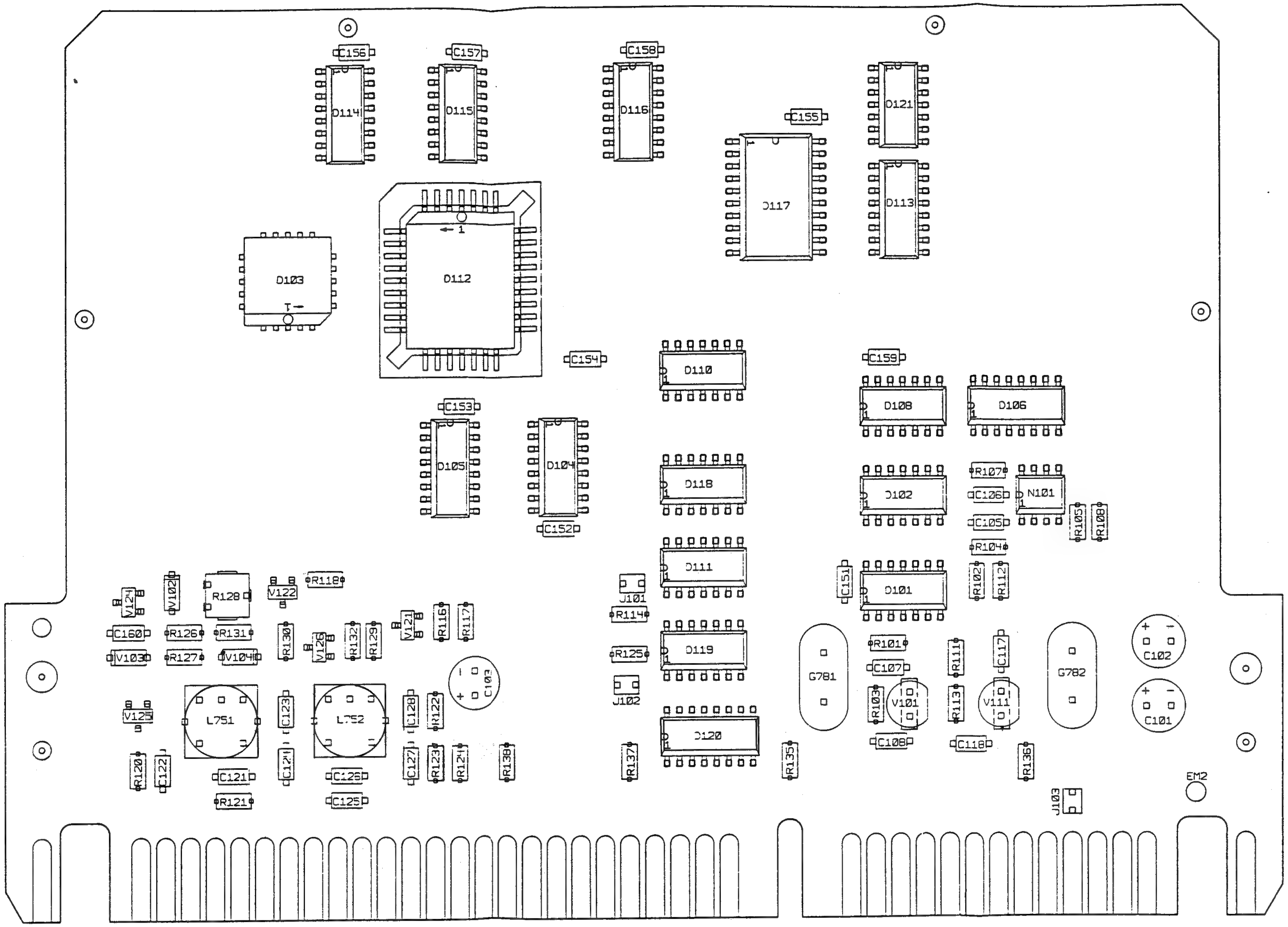
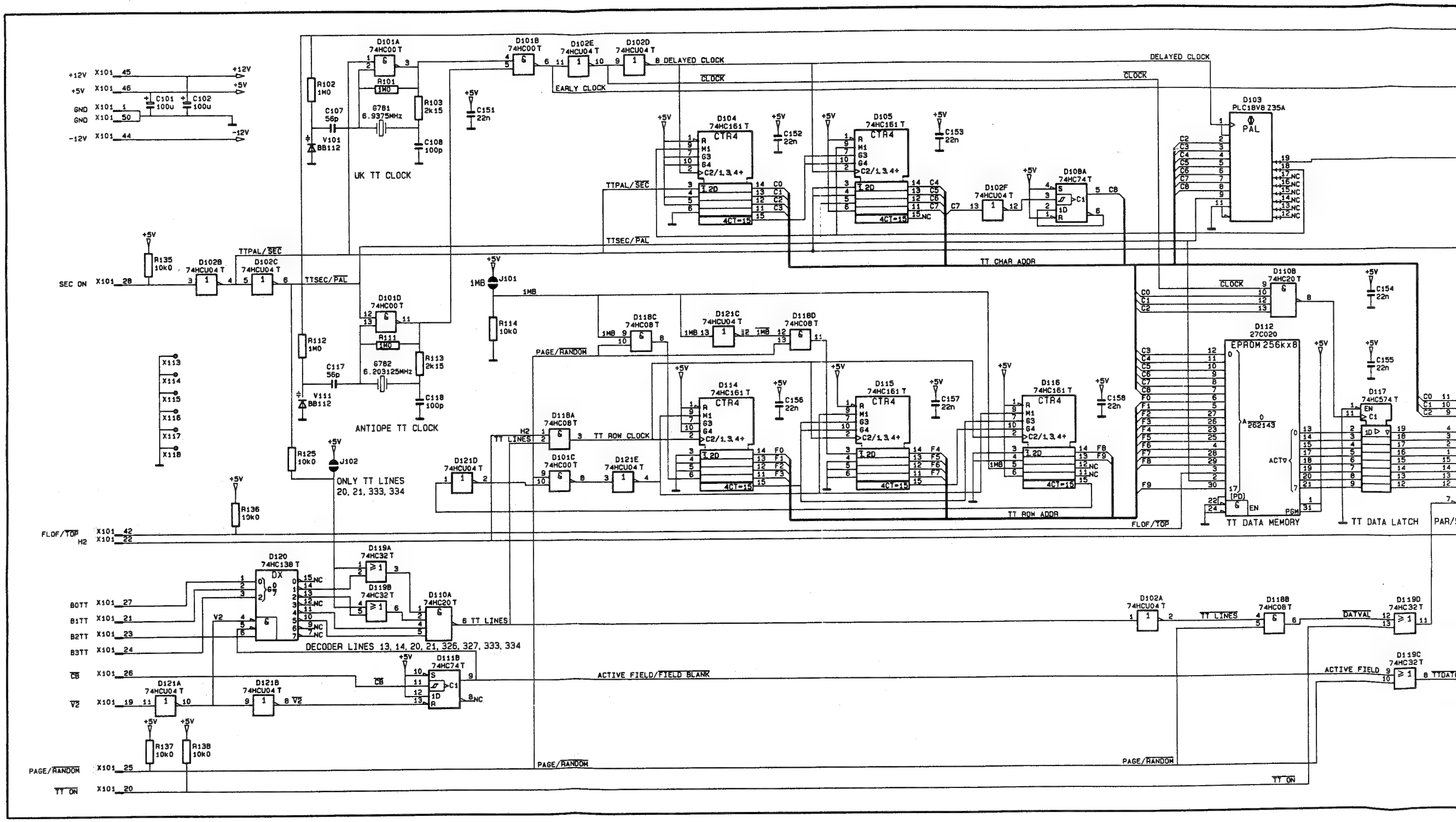


Fig. 123 **Unit 4, TELETEXT TOP/FLOF**



+12V
+5V
GND
-12V
SEC ON
FLOF/TOP
H2
B0TT
B1TT
B2TT
B3TT
CB
V2
PAGE/RANDOM
TT ON
D101A 74HC00T
D101B 74HC00T
D102E 74HCU04T
D102D 74HCU04T
DELAYED CLOCK
CLOCK
EARLY CLOCK
UK TT CLOCK
ANTIOPE TT CLOCK
G781 6.9375MHz
G782 6.203125MHz
D104 74HC161T
D105 74HC161T
D108A 74HC74T
D103 PLC18V8 Z35A
PAL
TTPAL/SEC
TTSEC/PAL
TT CHAR ADDR
D110B 74HC20T
D112 27C020
EPROM 256kx8
TT DATA MEMORY
D117 74HC574T
TT DATA LATCH
D114 74HC161T
D115 74HC161T
D116 74HC161T
TT ROW CLOCK
TT ROW ADDR
ONLY TT LINES 20, 21, 333, 334
D120 74HC138T
D119A 74HC32T
D119B 74HC32T
D110A 74HC20T
TT LINES
DECODER LINES 13, 14, 20, 21, 326, 327, 333, 334
D111B 74HC74T
ACTIVE FIELD/FIELD BLANK
D121A 74HCU04T
D121B 74HCU04T
D102A 74HCU04T
D118B 74HC08T
DATVAL
D119D 74HC32T
D119C 74HC32T
ACTIVE FIELD

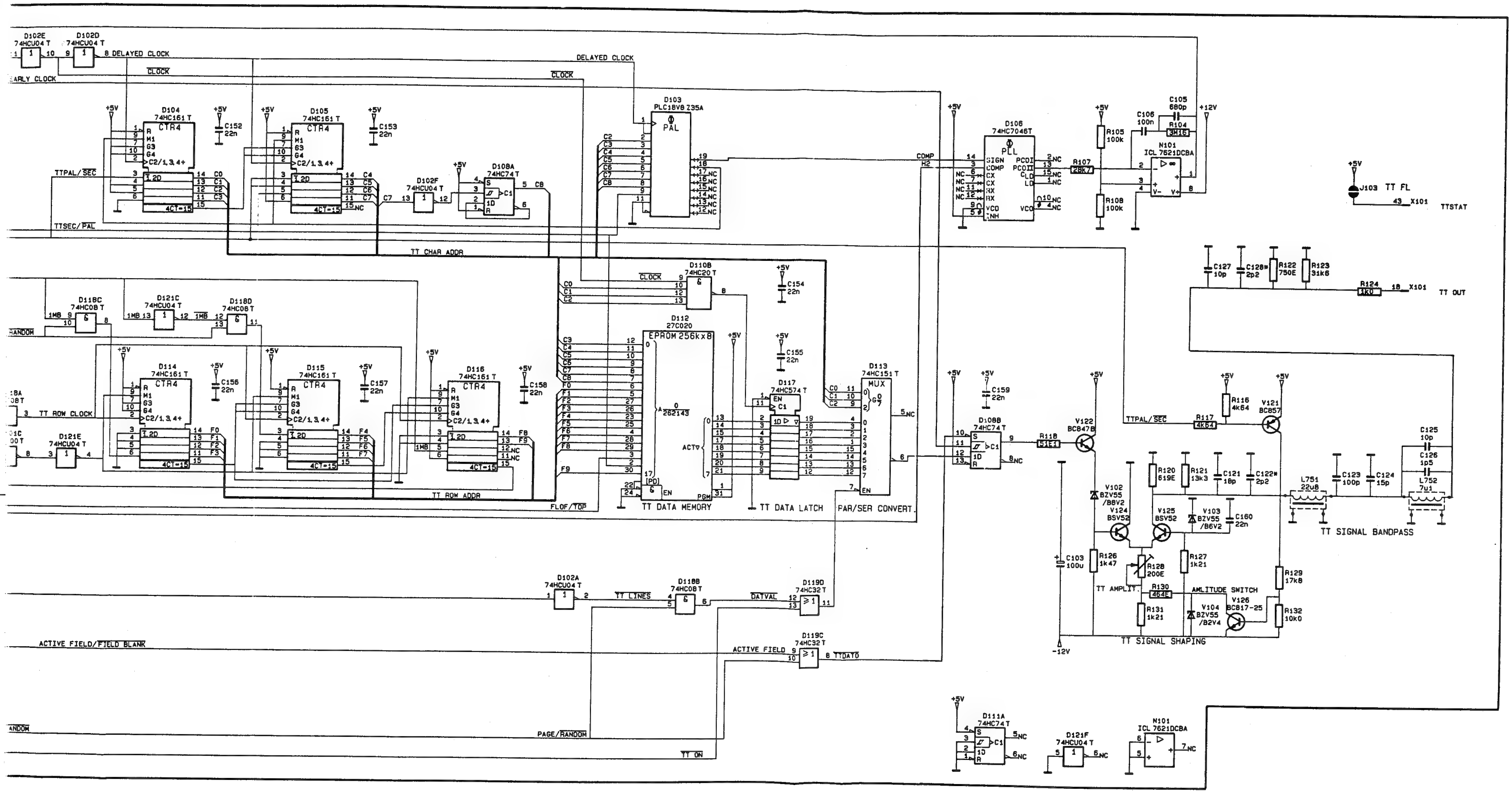


Fig. 124 Unit 4, TELETEXT TOP/FLOF

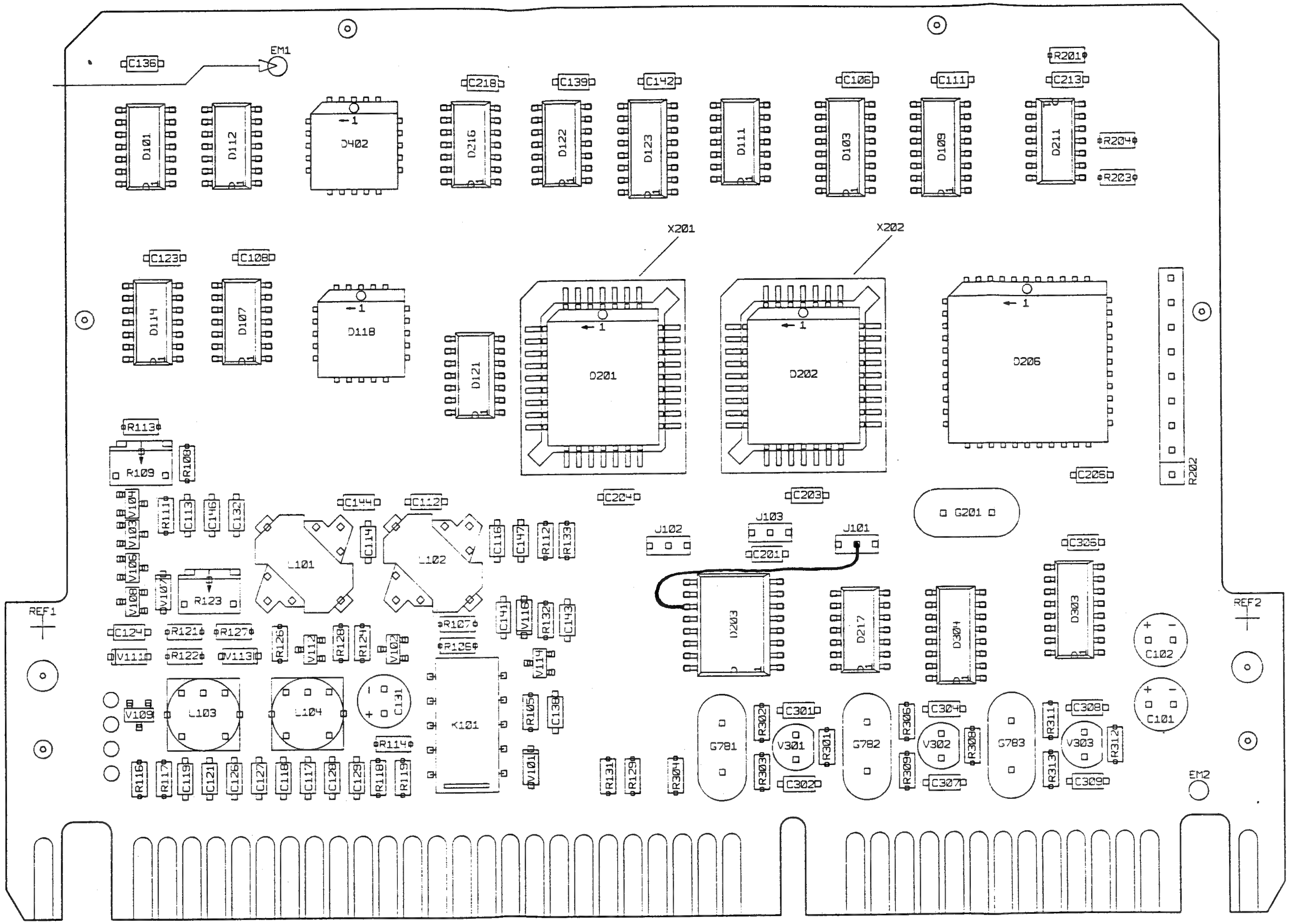


Fig. 125 **Unit 4/PDC, TELETEXT / PDC / CC, Component Layout**

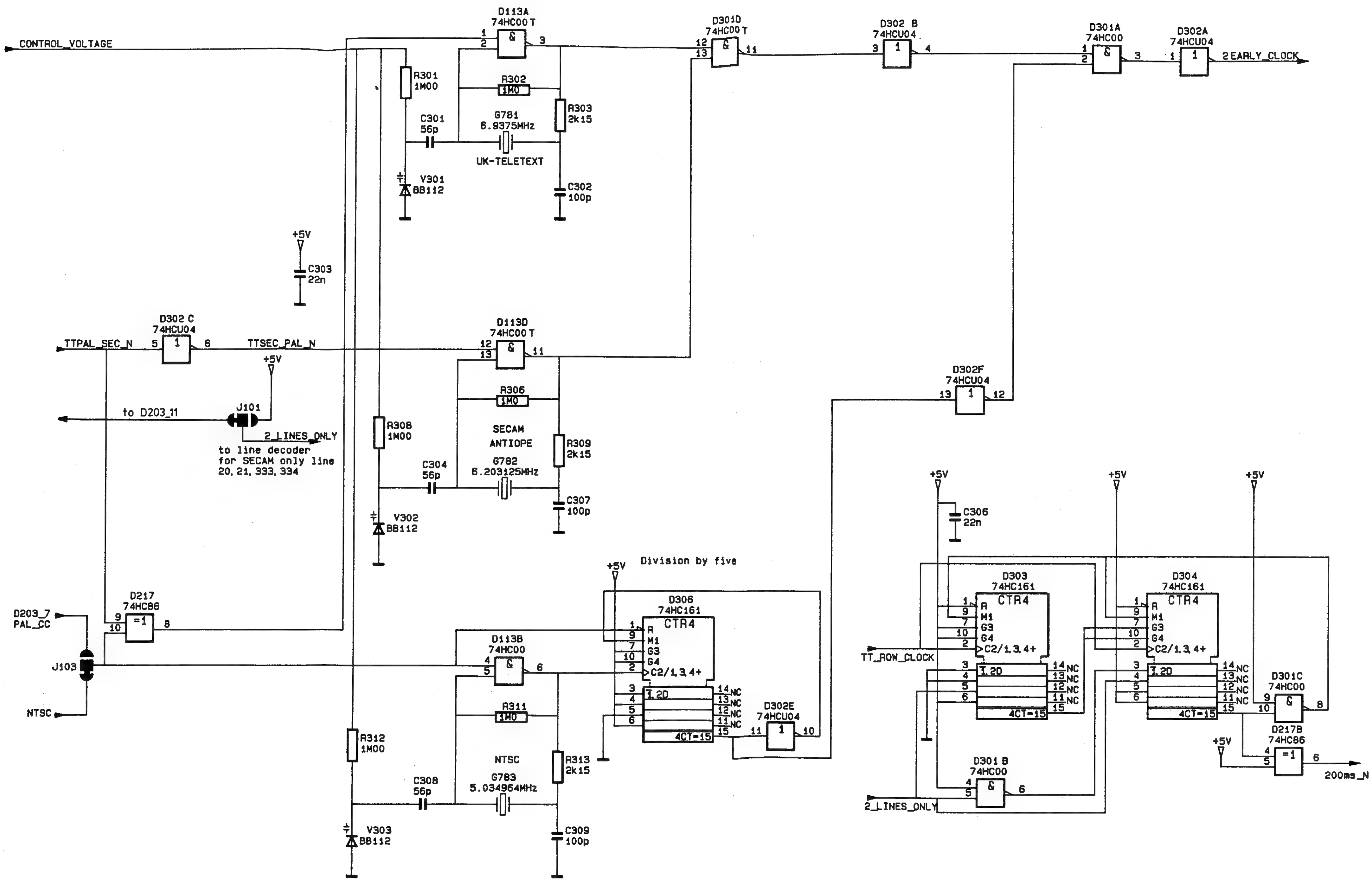


Fig. 126 Unit 4/PDC,
TELETEXT / PDC / CC, Part 1

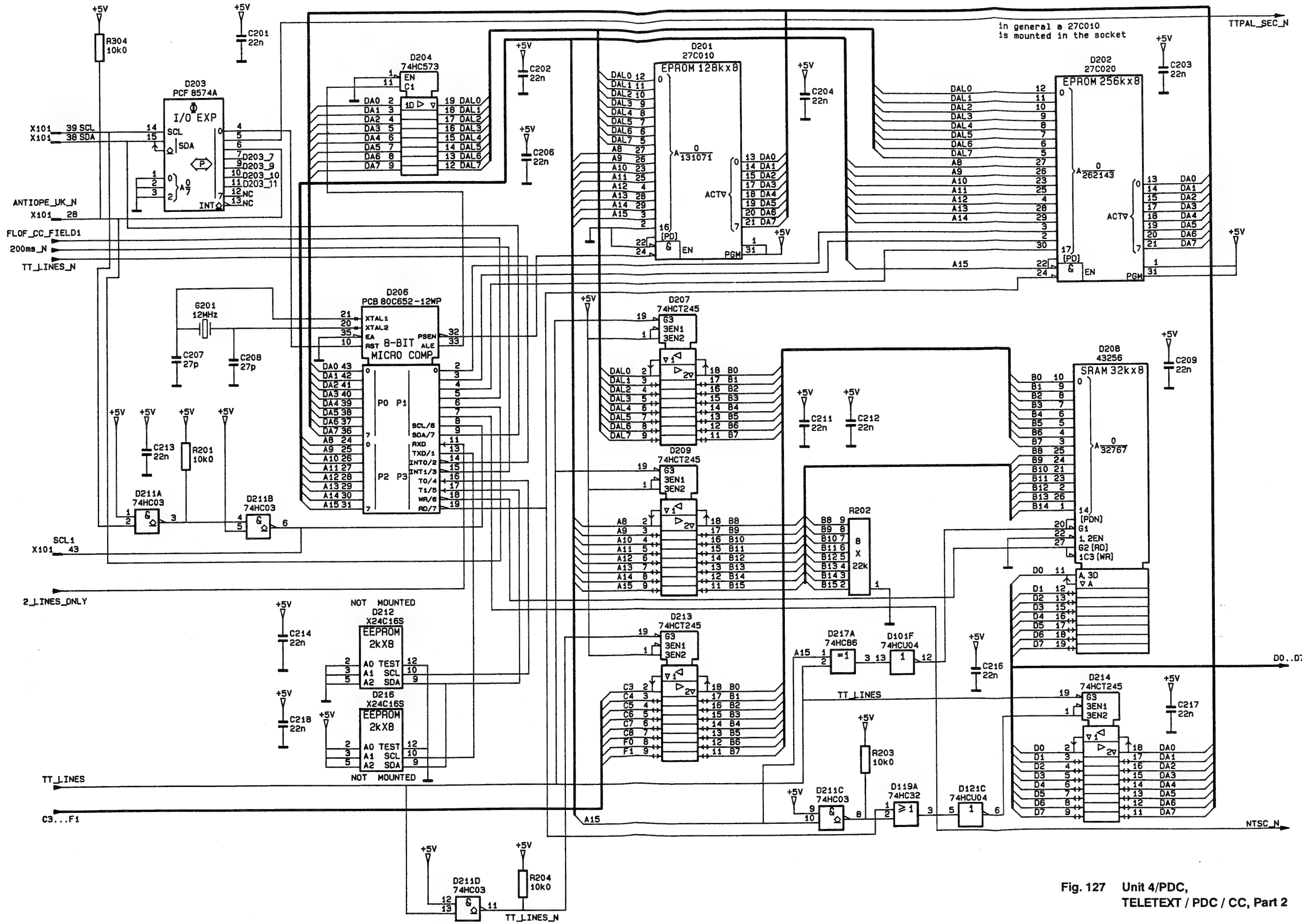
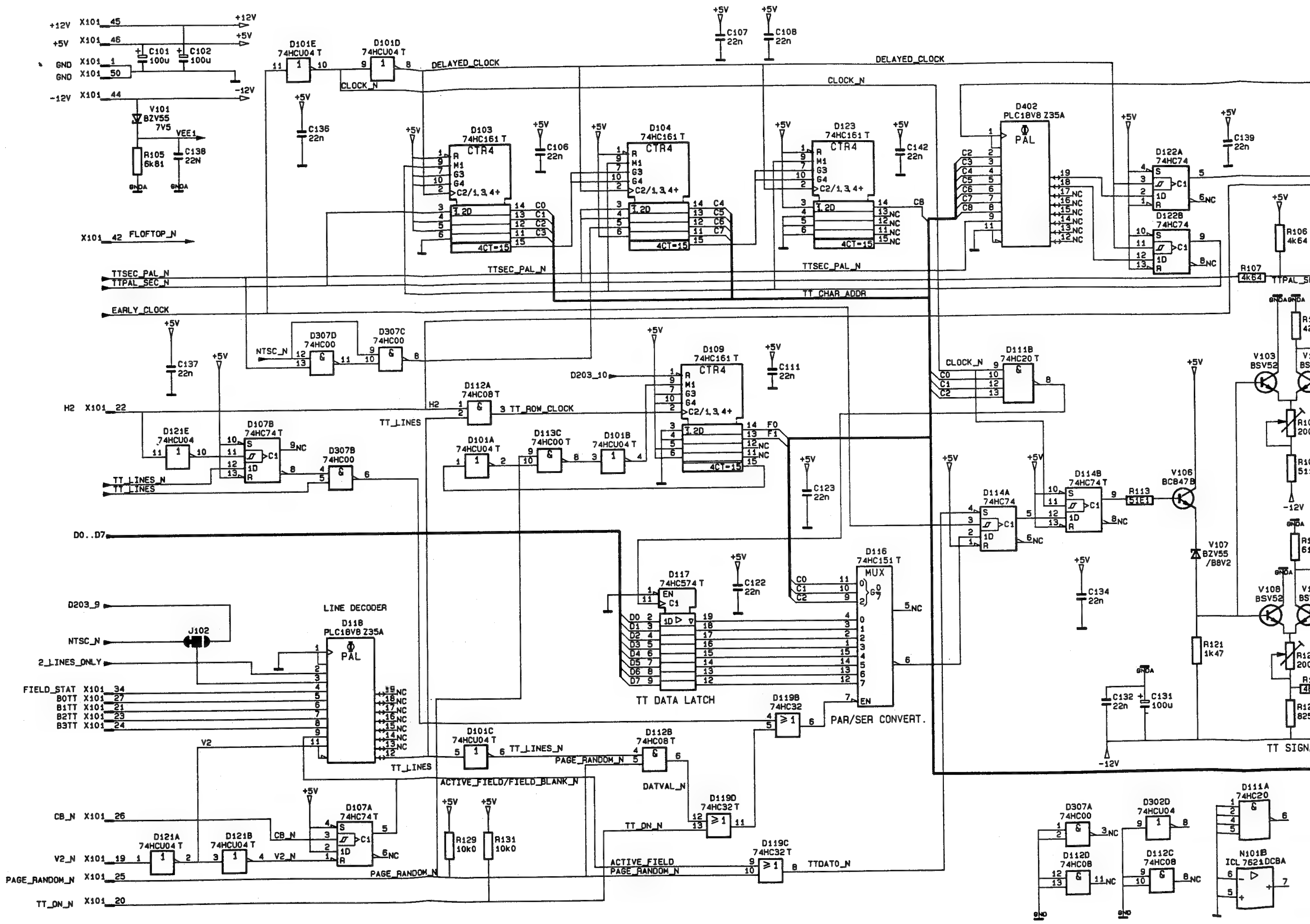


Fig. 127 Unit 4/PDC, TELETEXT / PDC / CC, Part 2



LINE DECODER
TT DATA LATCH
PAR/SER CONVERT.
DELAYED_CLOCK
CLOCK_N
TTSEC_PAL_N
TTPAL_SEC_N
EARLY_CLOCK
TT_CHAR_ADDR
TT_ROW_CLOCK
TT_LINES_N
TT_LINES
D0..D7
ACTIVE_FIELD/FIELD_BLANK_N
PAGE_RANDOM_N
TT_ON_N
TTDATO_N
DATVAL_N

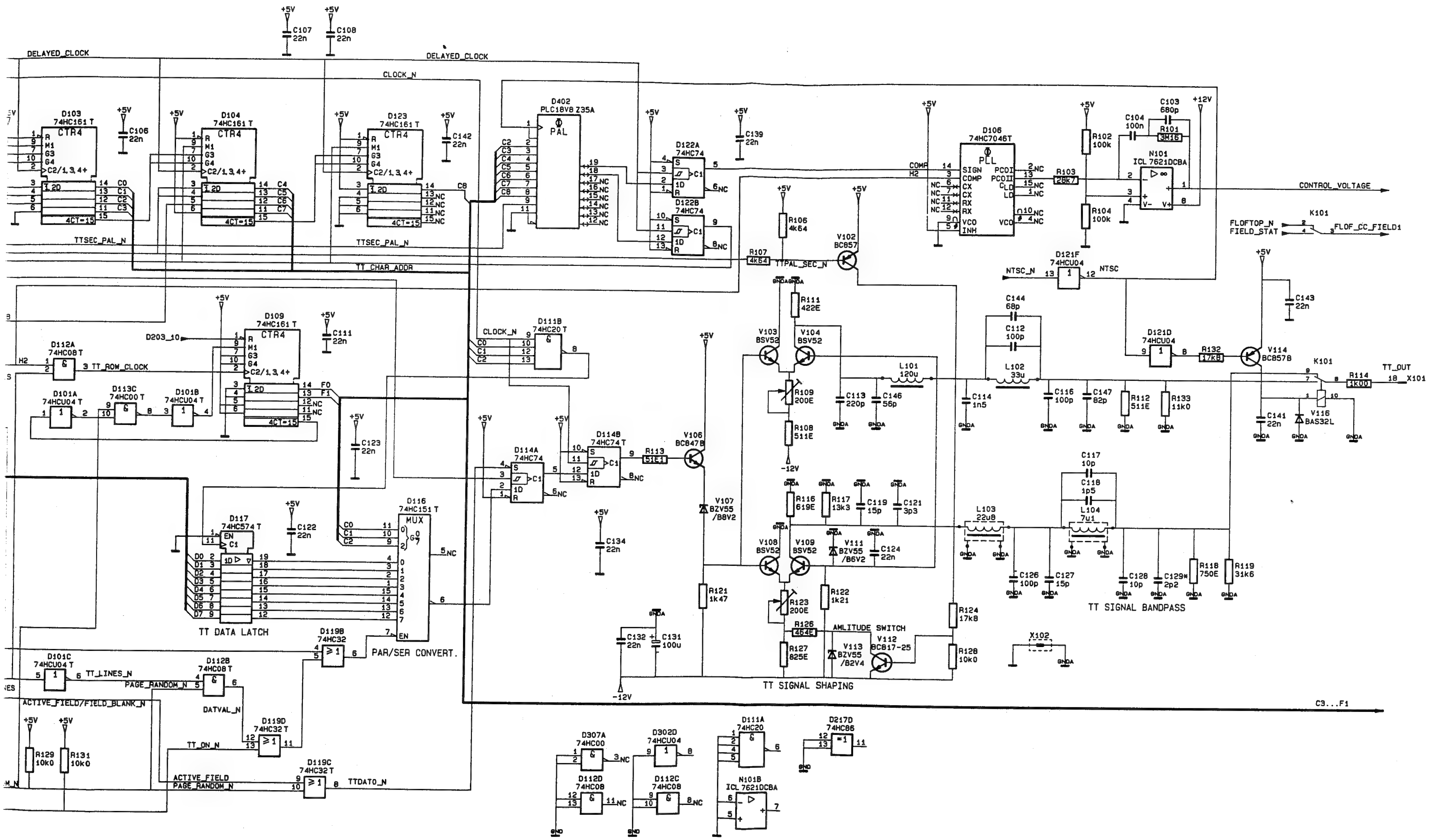
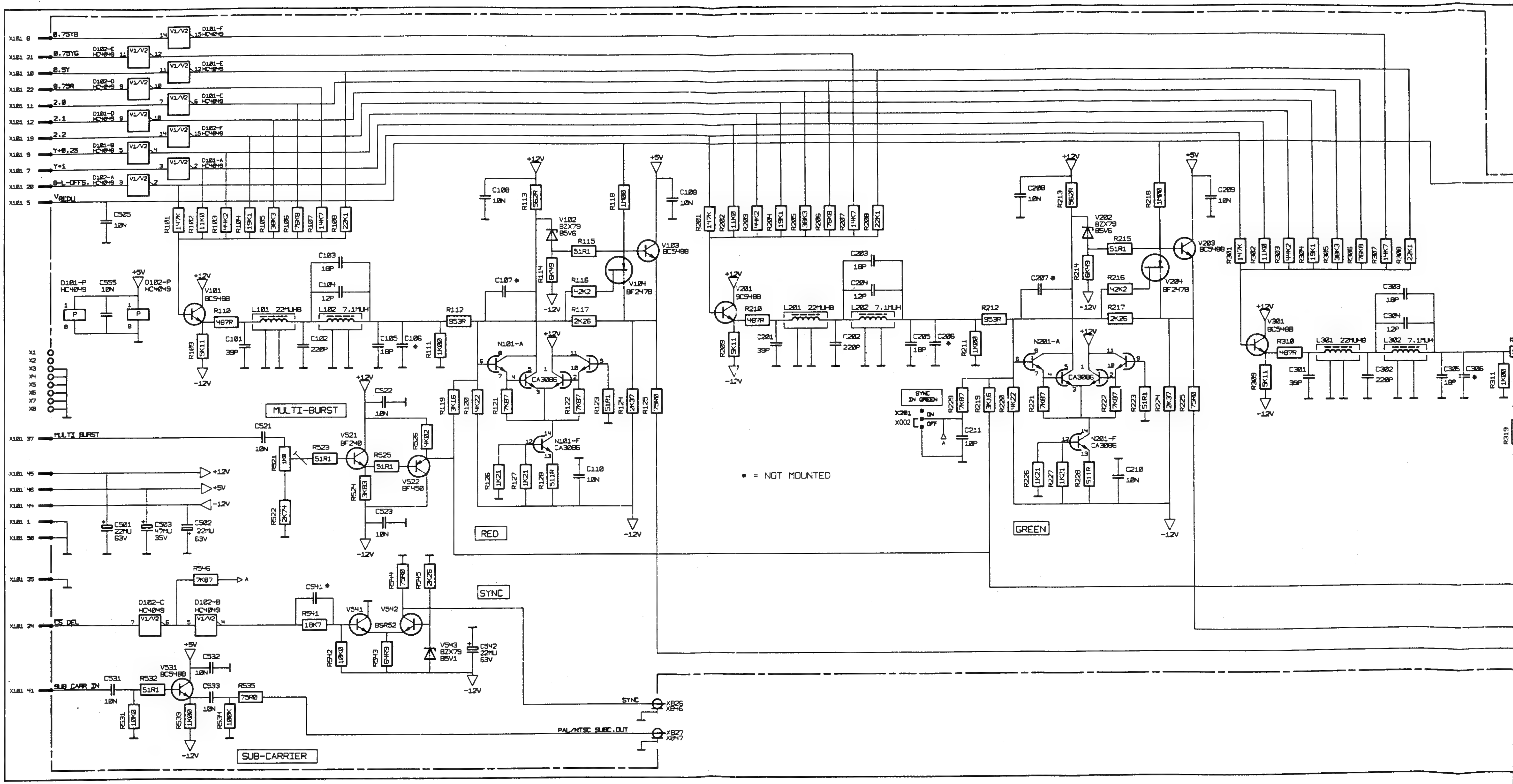


Fig. 128 Unit 4/PDC, TELETEXT / PDC / CC, Part 3


MULTI-BURST
RED
GREEN
SYNC
SUB-CARRIER
* = NOT MOUNTED
SYNC IN GREEN
PAL/NTSC SUBC.OUT

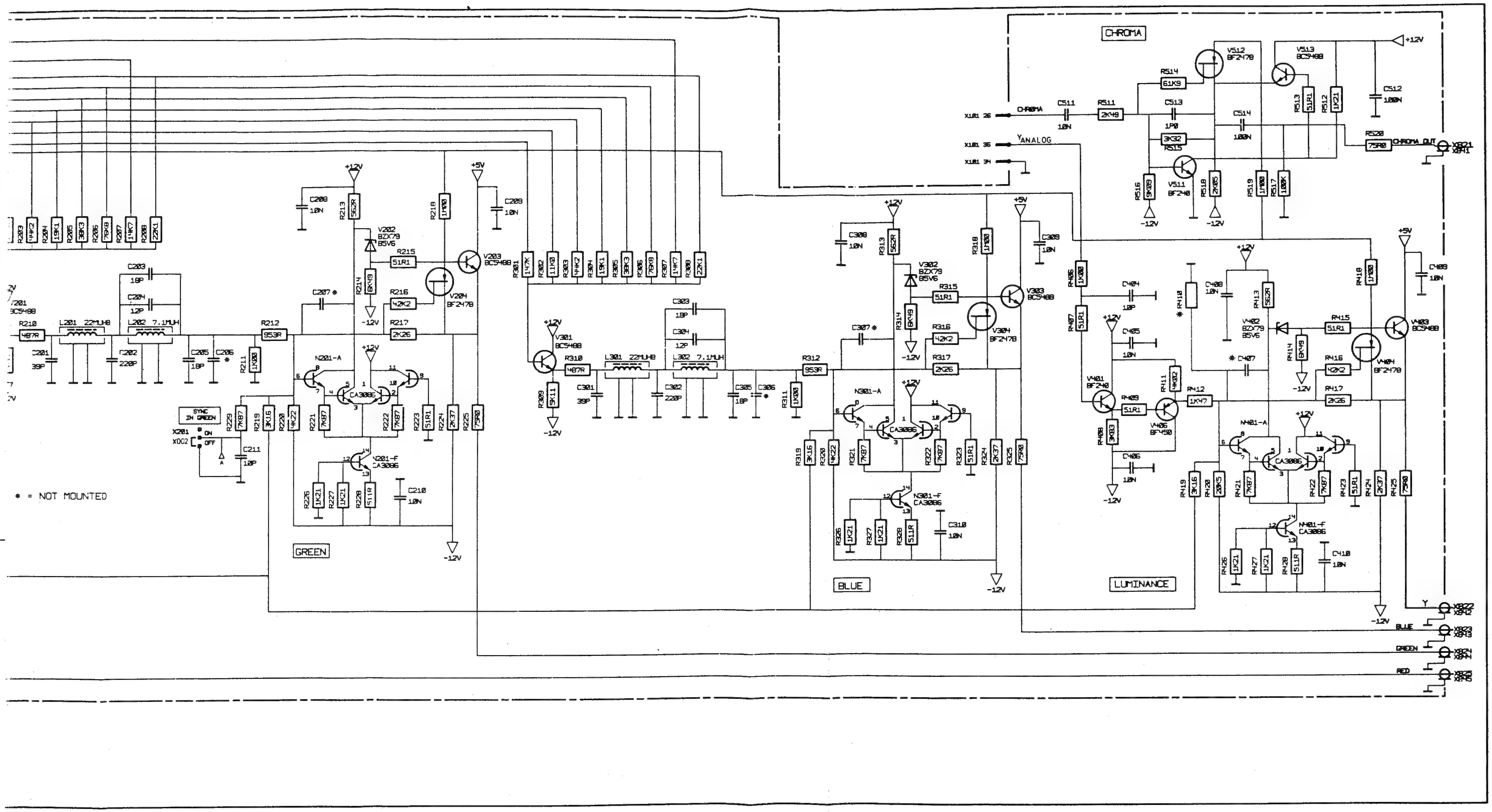


Fig. 130 Unit 5, RGB + Y/C Unit

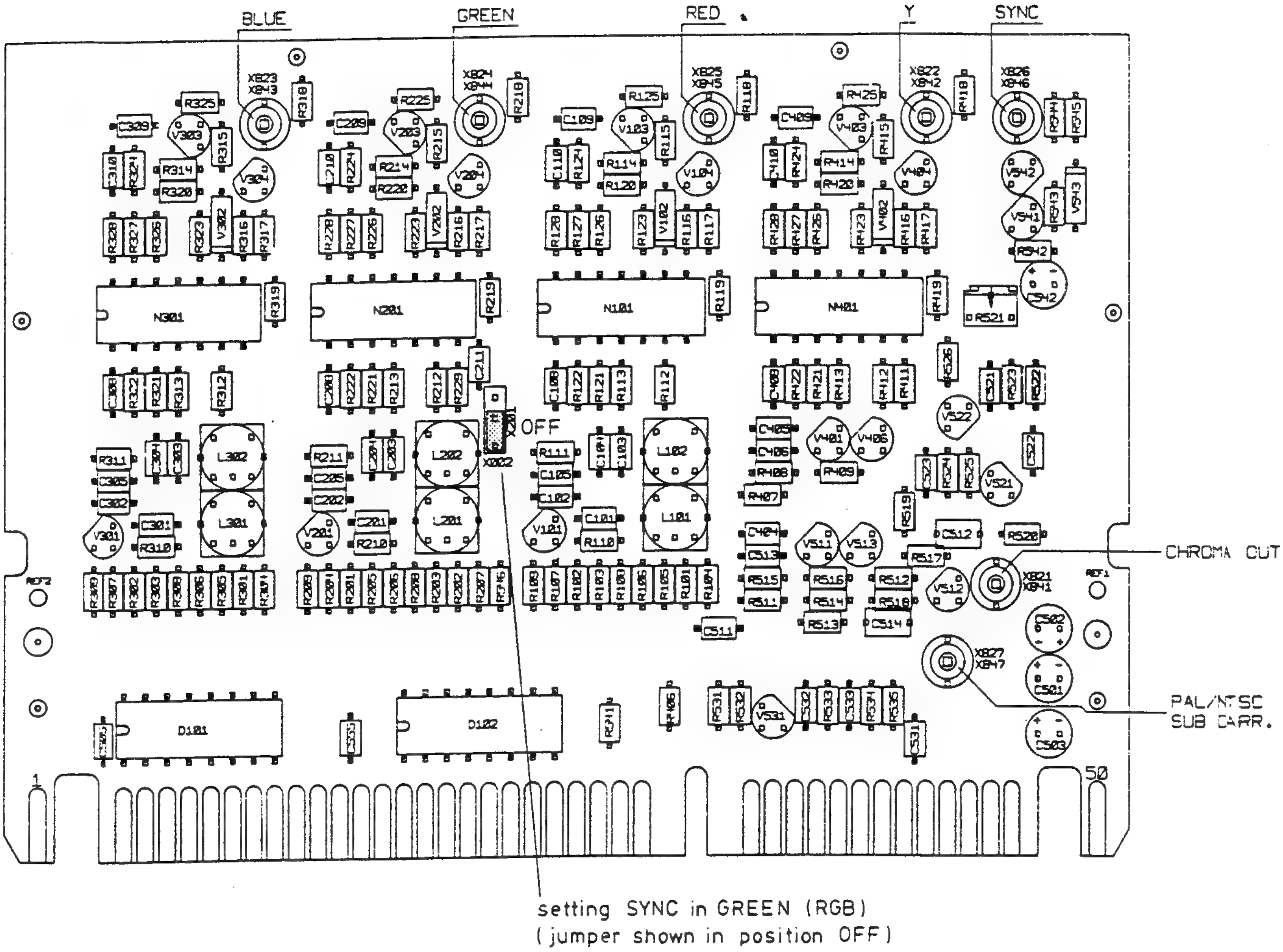


Fig. 129 **Unit 5, RGB + Y/C Unit**
Component Layout

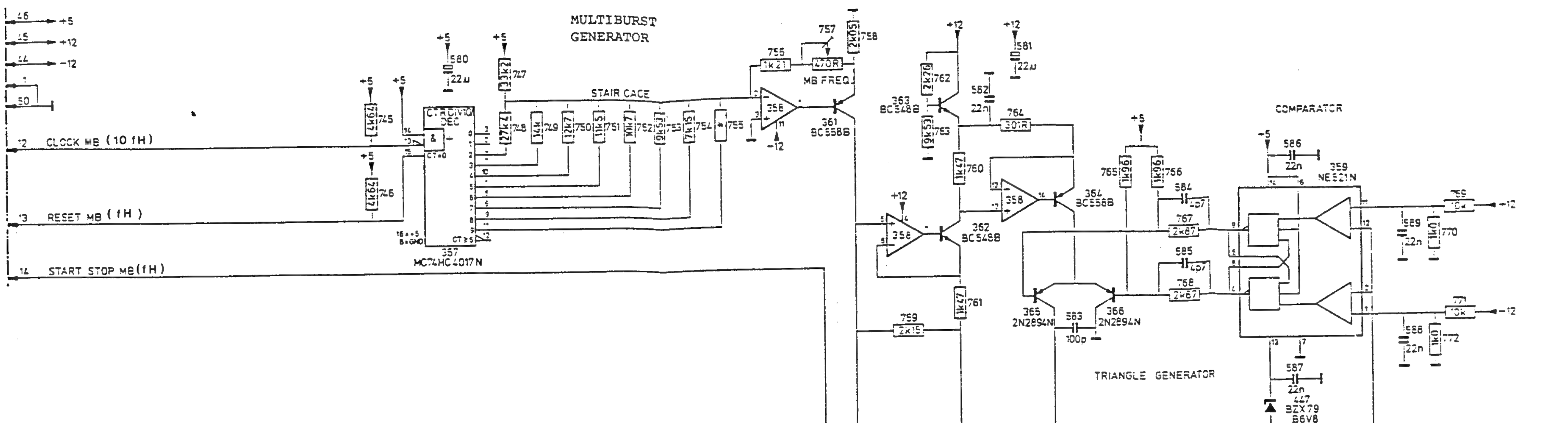
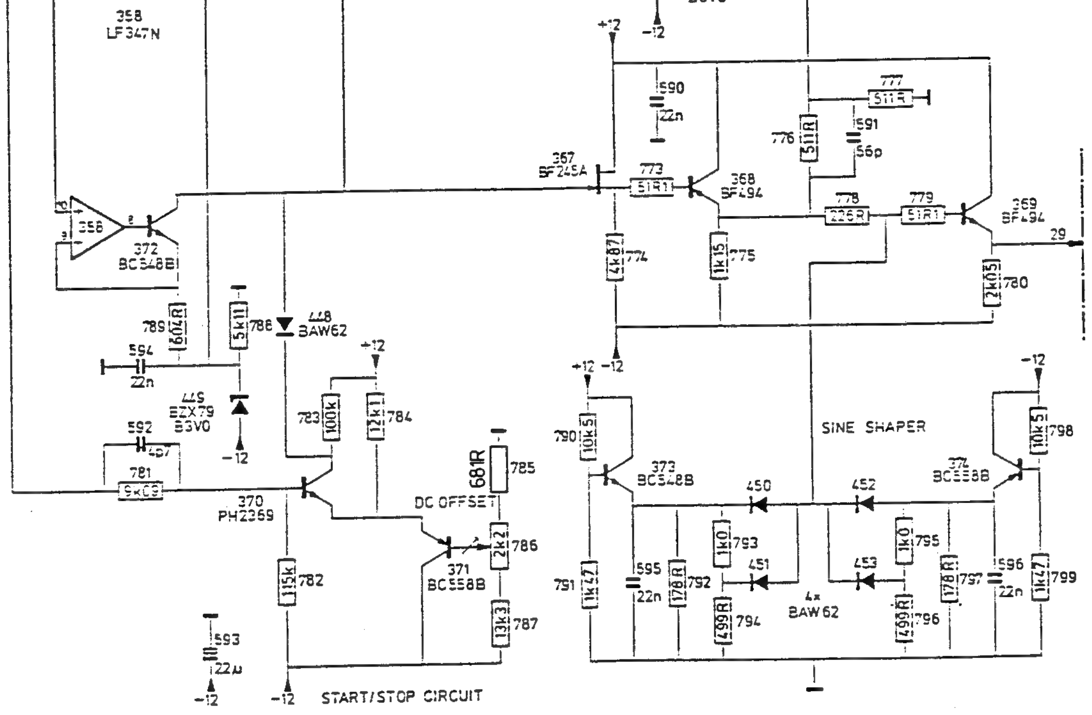



Fig. 132 Unit 6, MULTIBURST

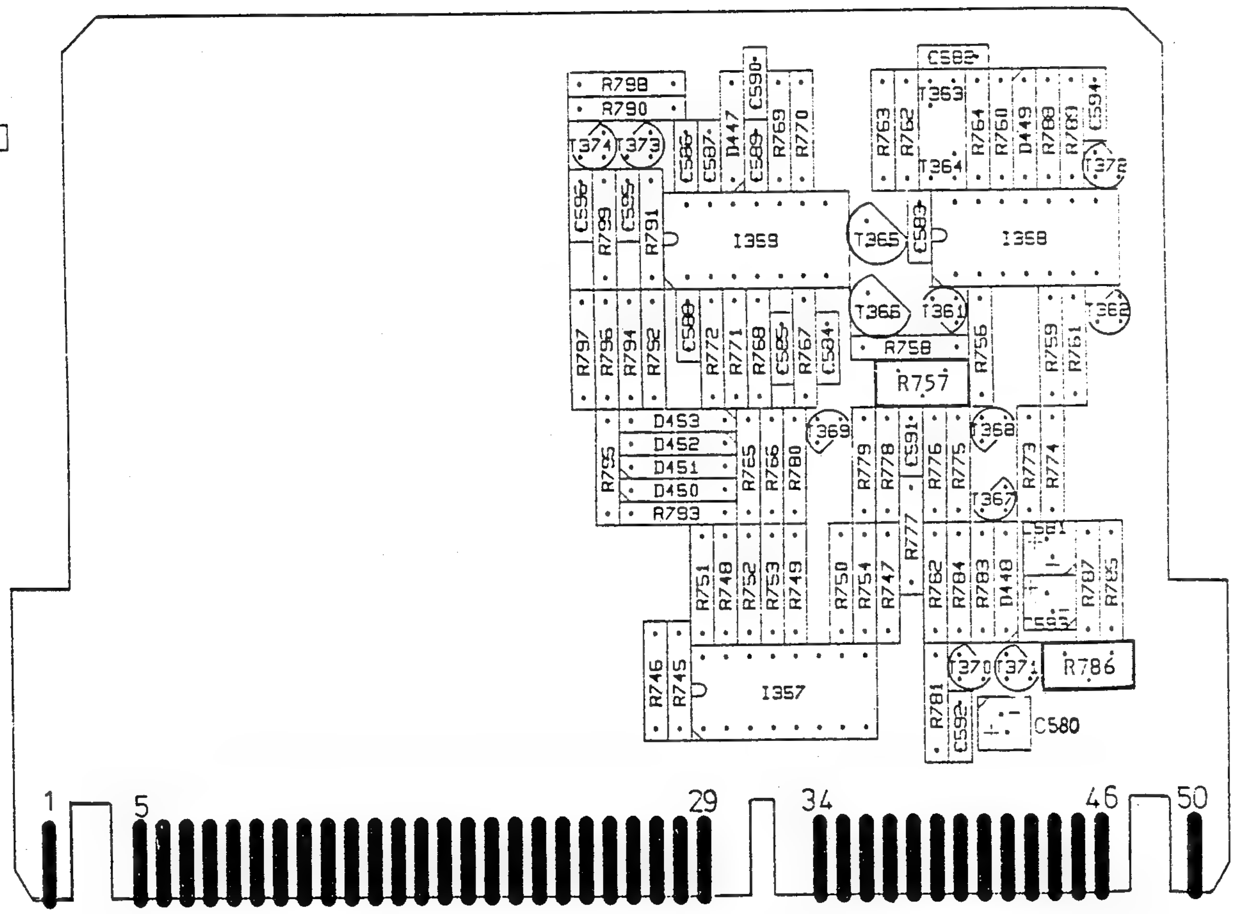


Fig. 131 Unit 6, MULTIBURST

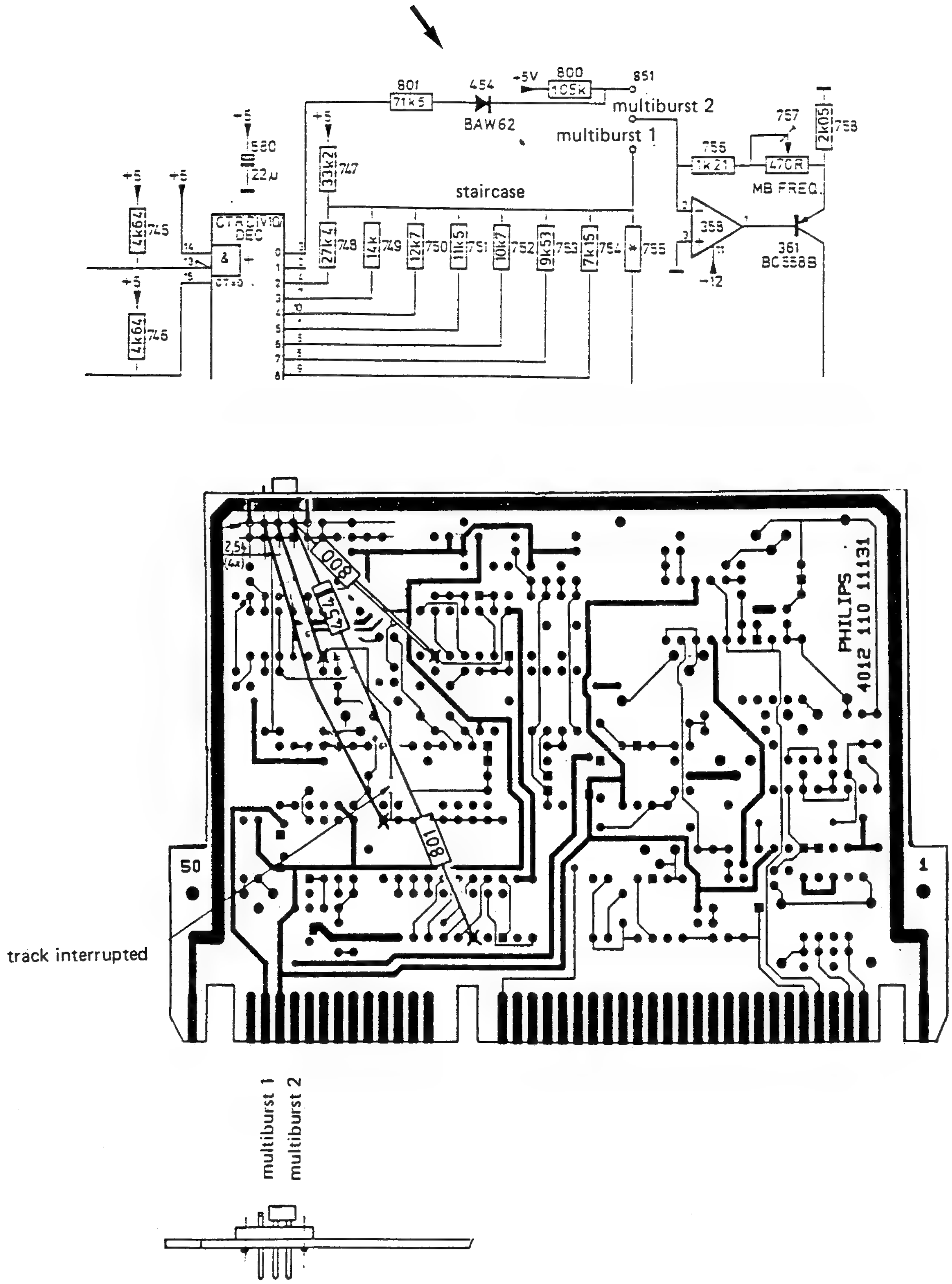


Fig. 133 Unit 6/IEEE, MULTIBURST

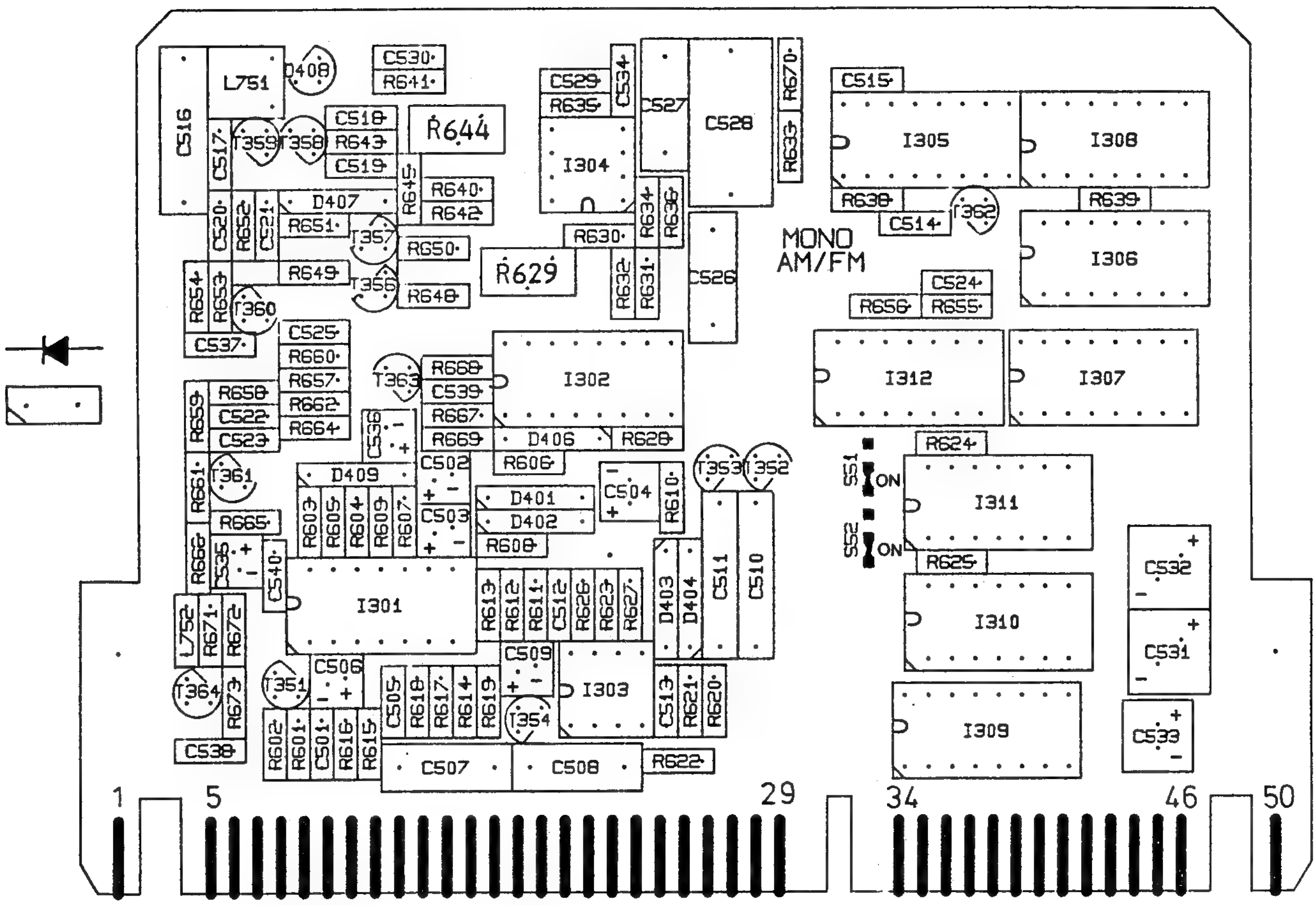
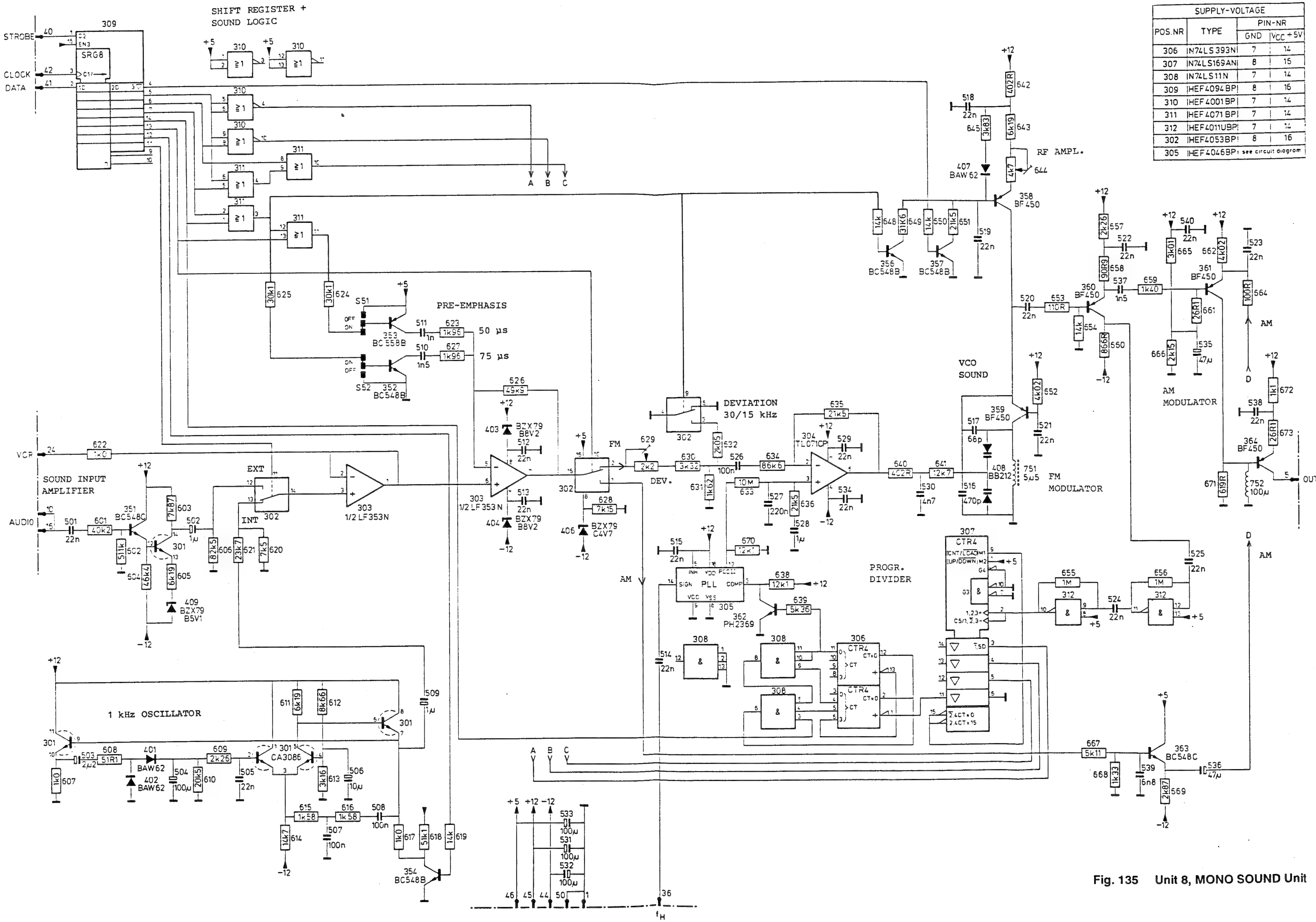
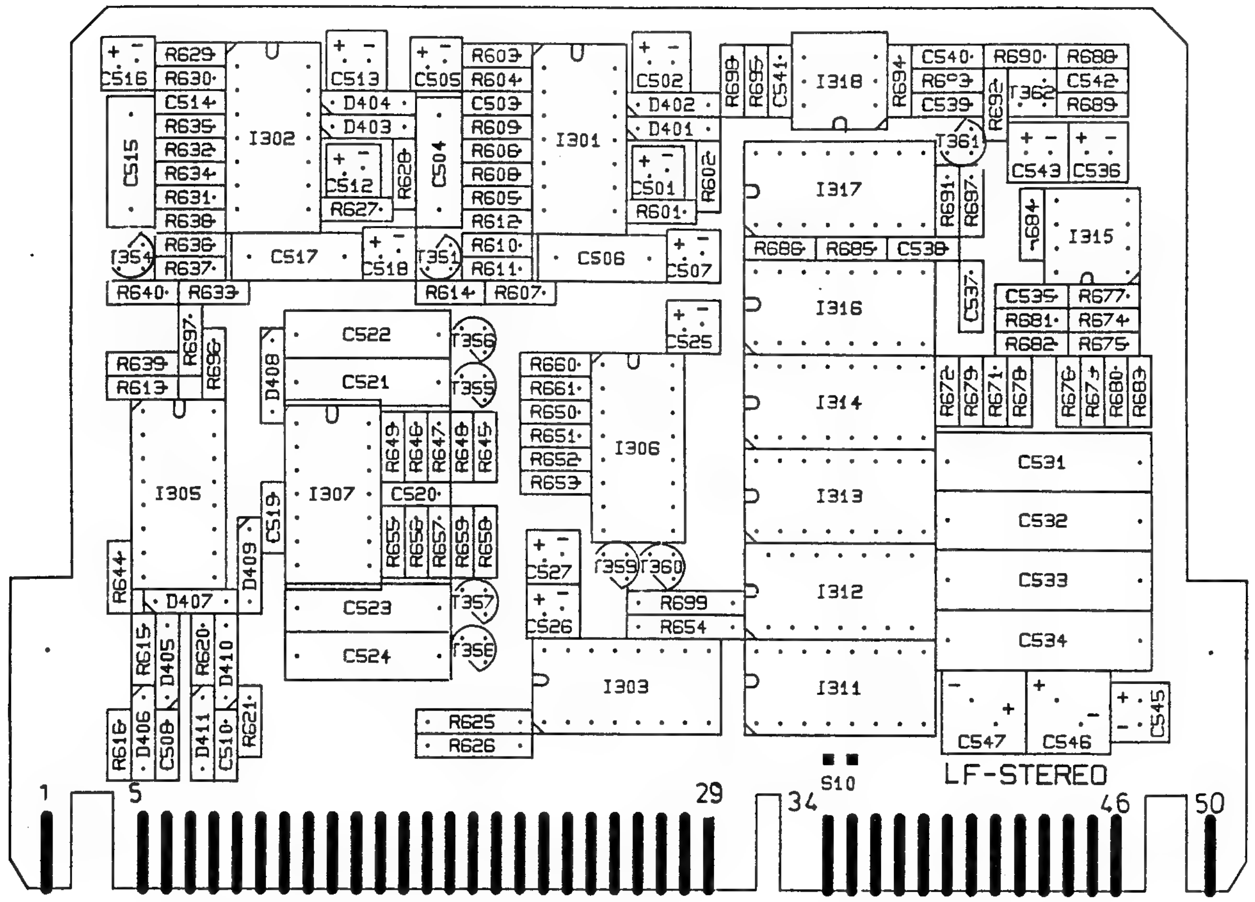


Fig. 134 Unit 8, MONO SOUND Unit



SUPPLY-VOLTAGE			
POS.NR	TYPE	PIN-NR	
		GND	VCC +5V
306	IN74LS393N	7	14
307	IN74LS169AN	8	15
308	IN74LS11N	7	14
309	HEF4094BP	8	16
310	HEF4001BP	7	14
311	HEF4071BP	7	14
312	HEF4011UBP	7	14
302	HEF4053BP	8	16
305	HEF4046BP	see circuit diagram	

Fig. 135 Unit 8, MONO SOUND Unit



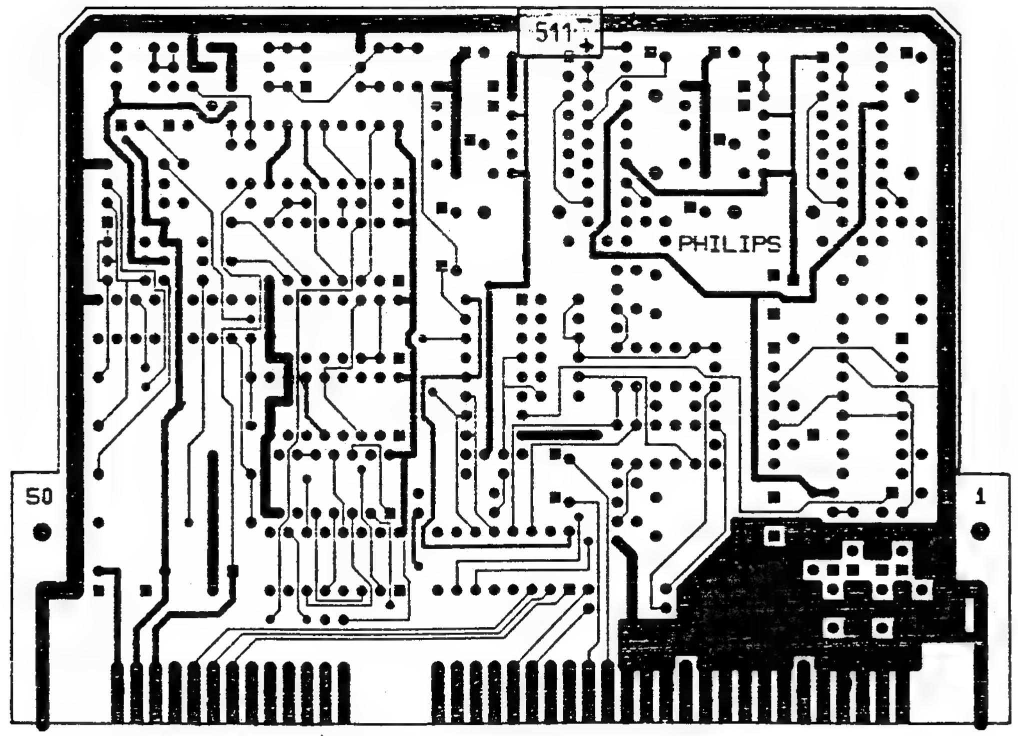
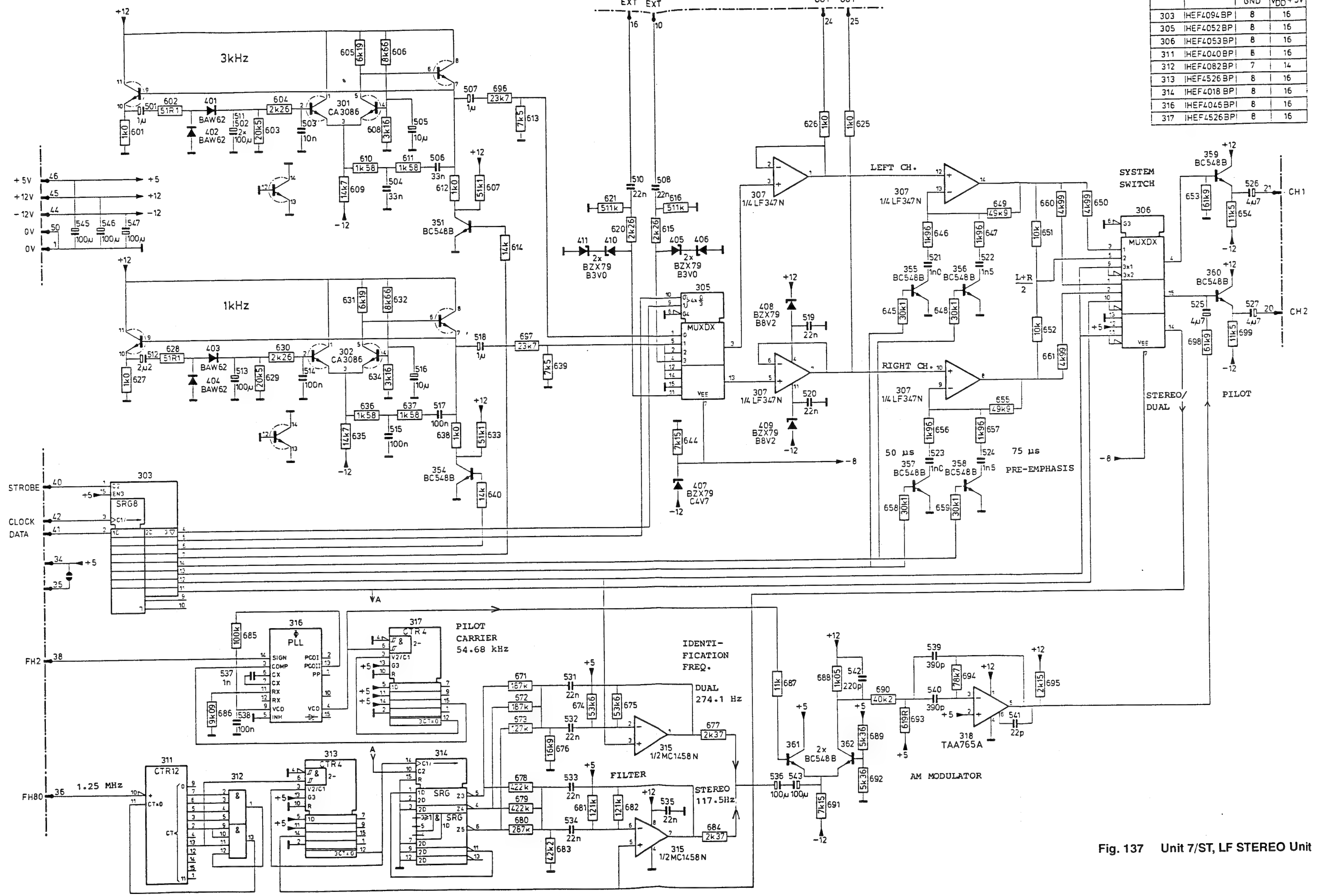
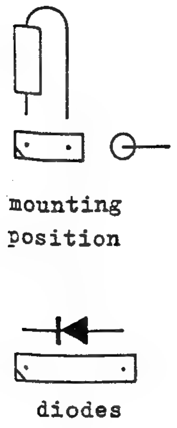


Fig. 136 Unit 7/ST, LF STEREO Unit



POS. NR.	TYPE	PIN NR GND	PIN NR V_{DD} +5V
303	HEF4094BP	8	16
305	HEF4052BP	8	16
306	HEF4053BP	8	16
311	HEF4040BP	8	16
312	HEF4082BP	7	14
313	HEF4526BP	8	16
314	HEF4018BP	8	16
316	HEF4046BP	8	16
317	HEF4526BP	8	16

Fig. 137 Unit 7/ST, LF STEREO Unit



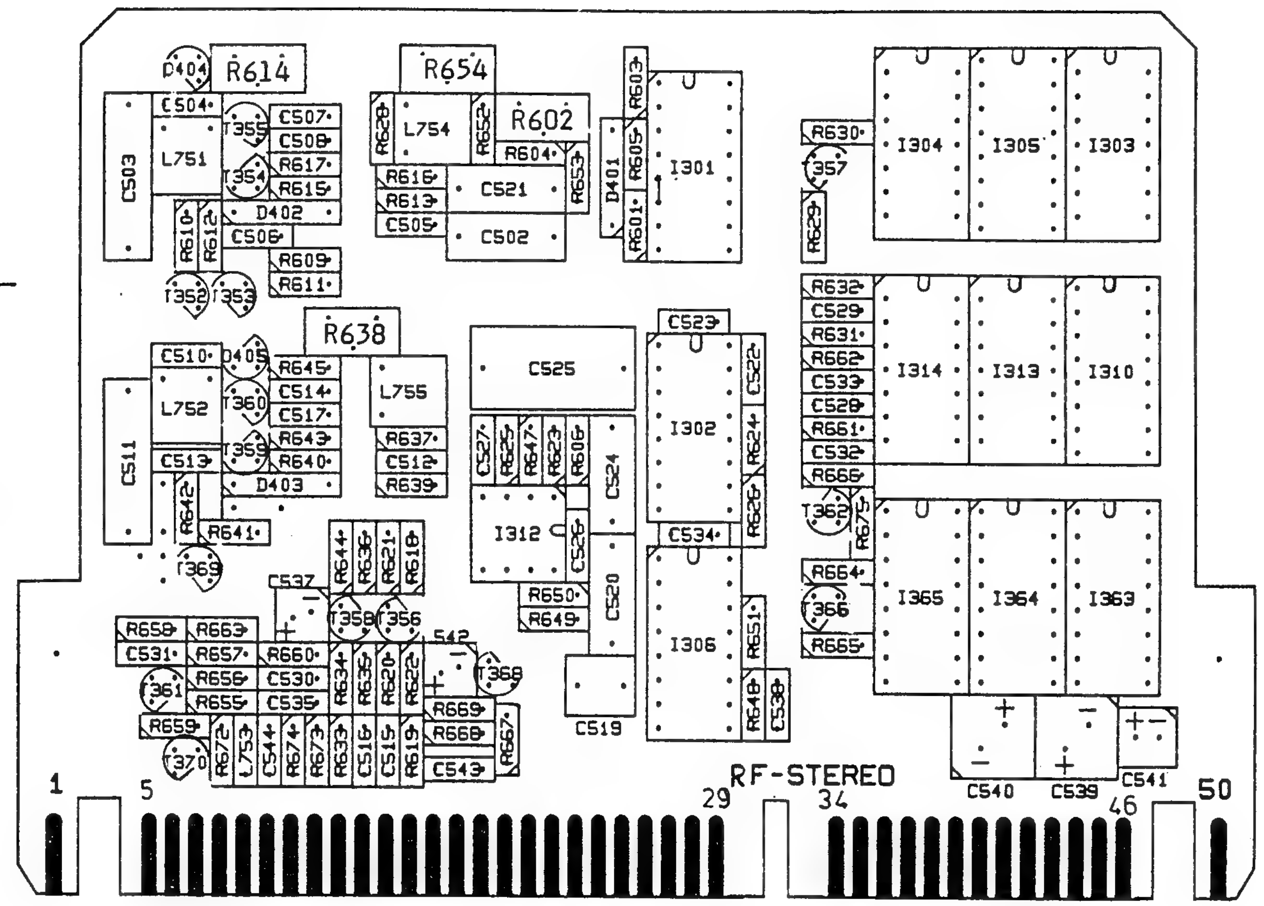
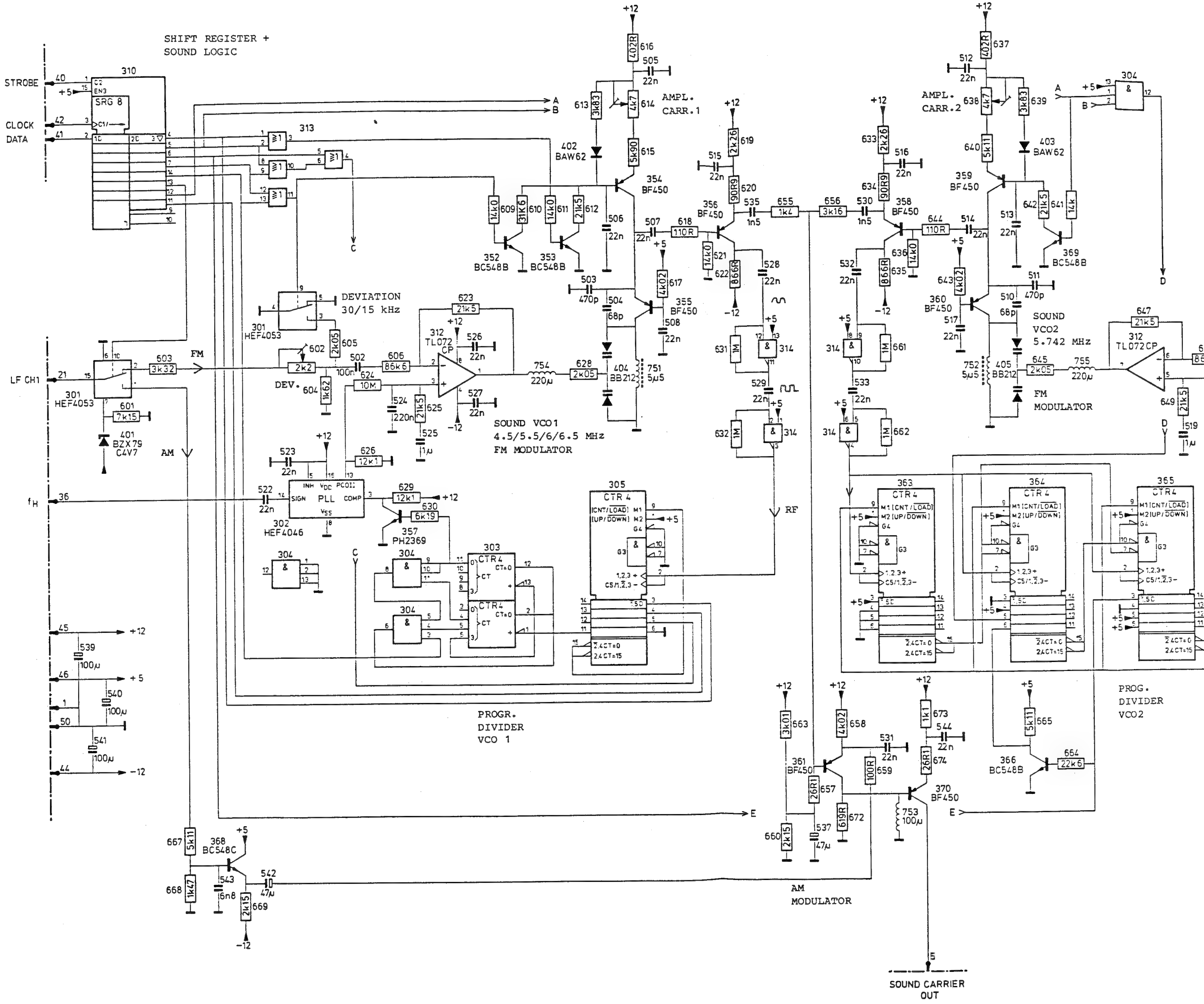
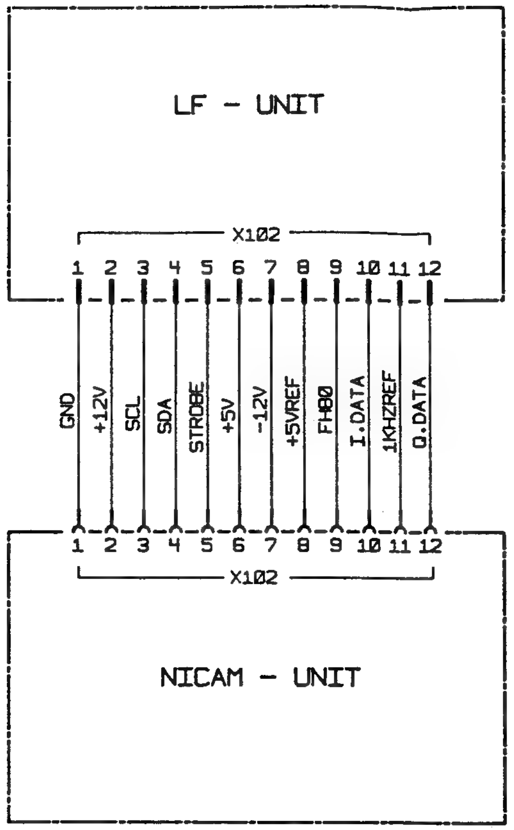


Fig. 138 Unit 8/ST, RF STEREO Unit



SUPPLY-VOLTAGE			
POS.NR	TYPE	PIN-NR GND	PIN-NR VCC +5V
303	N74LS393N	7	14
304	N74LS11N	7	14
305	N74LS169AN	8	16
310	HEF4094BP	8	16
313	HEF4071BP	7	14
314	HEF4011UBP	7	14
363	N74LS169AN	8	16
364	N74LS169AN	8	16
365	N74LS169AN	8	16
301	HEF4053BP	8	16

Fig. 139 Unit 8/ST, RF STEREO Unit



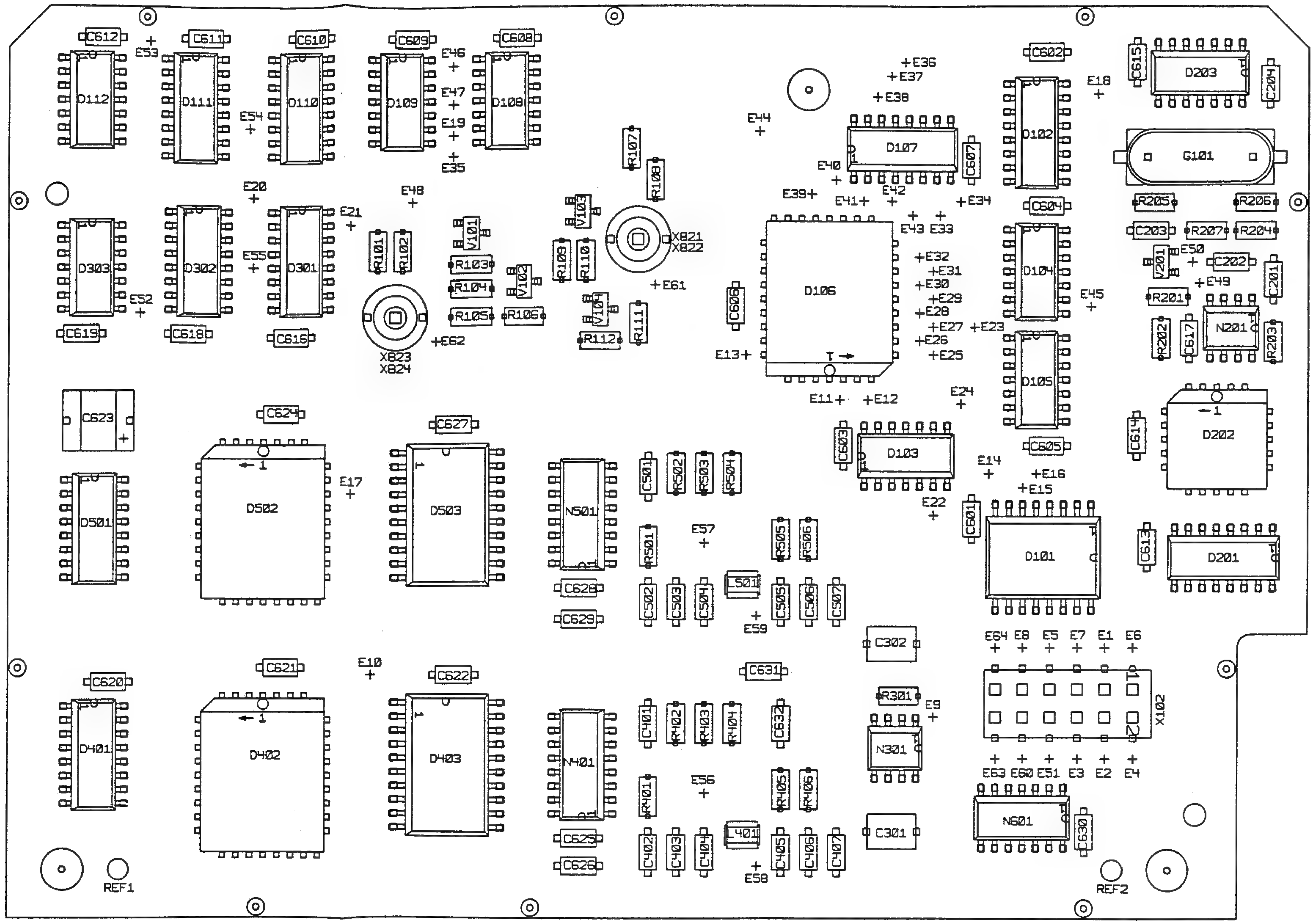
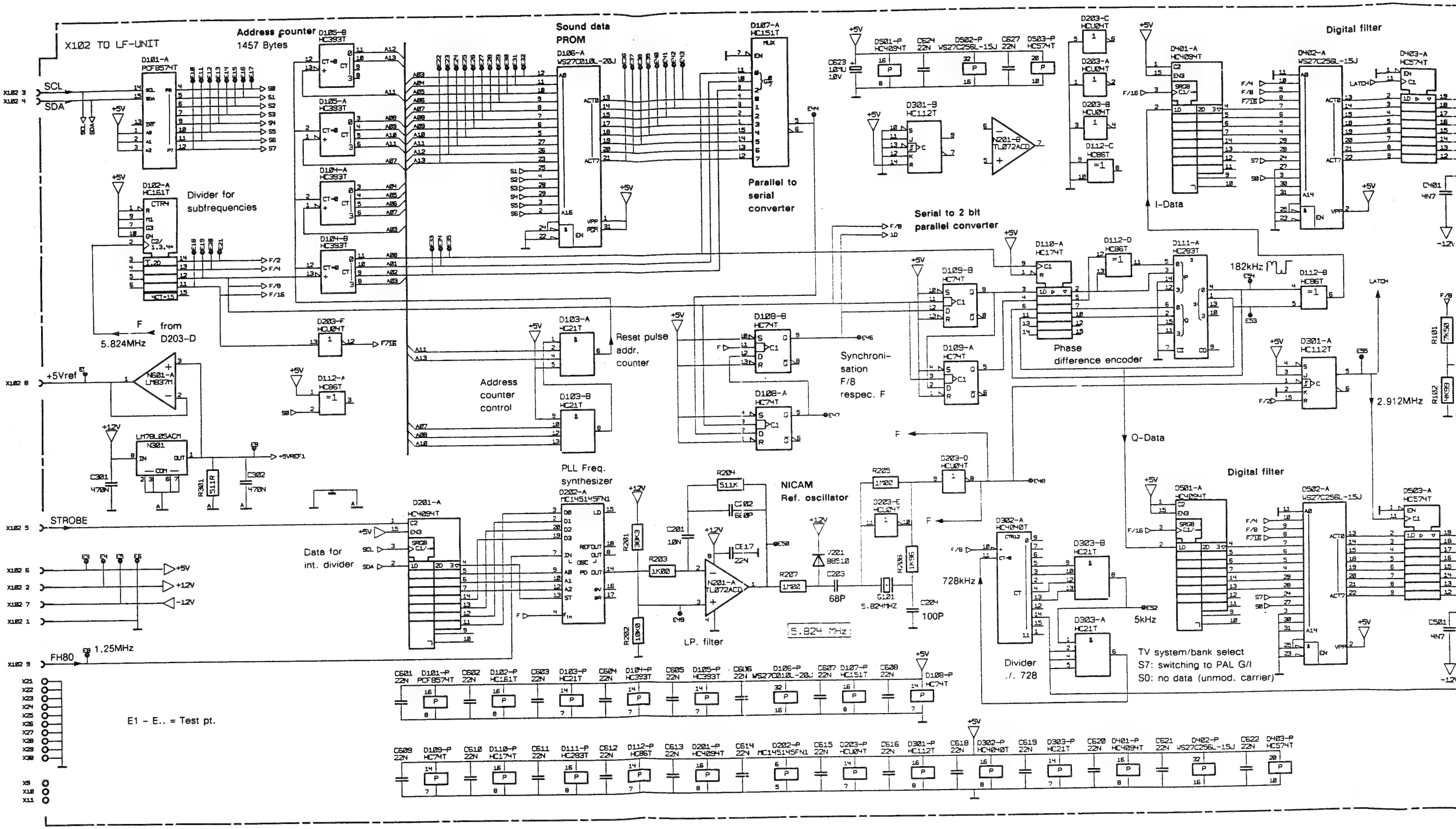


Fig. 140 Unit 7/TWIN, TWIN LF Unit


X102 TO LF-UNIT
Address counter
1457 Bytes
Sound data
PROM
Parallel to
serial
converter
Digital filter
Divider for
subfrequencies
from
D203-D
5.824MHz
Reset pulse
addr.
counter
Address
counter
control
Synchroni-
sation
F/8
respec. F
Serial to 2 bit
parallel converter
Phase
difference encoder
I-Data
Q-Data
182kHz
2.912MHz
PLL Freq.
synthesizer
NICAM
Ref. oscillator
Data for
int. divider
LP. filter
5.824 MHz
728kHz
5kHz
Divider
./. 728
TV system/bank select
S7: switching to PAL G/I
S0: no data (unmod. carrier)
STROBE
FH80
1,25MHz
SCL
SDA
+5Vref
E1 - E.. = Test pt.

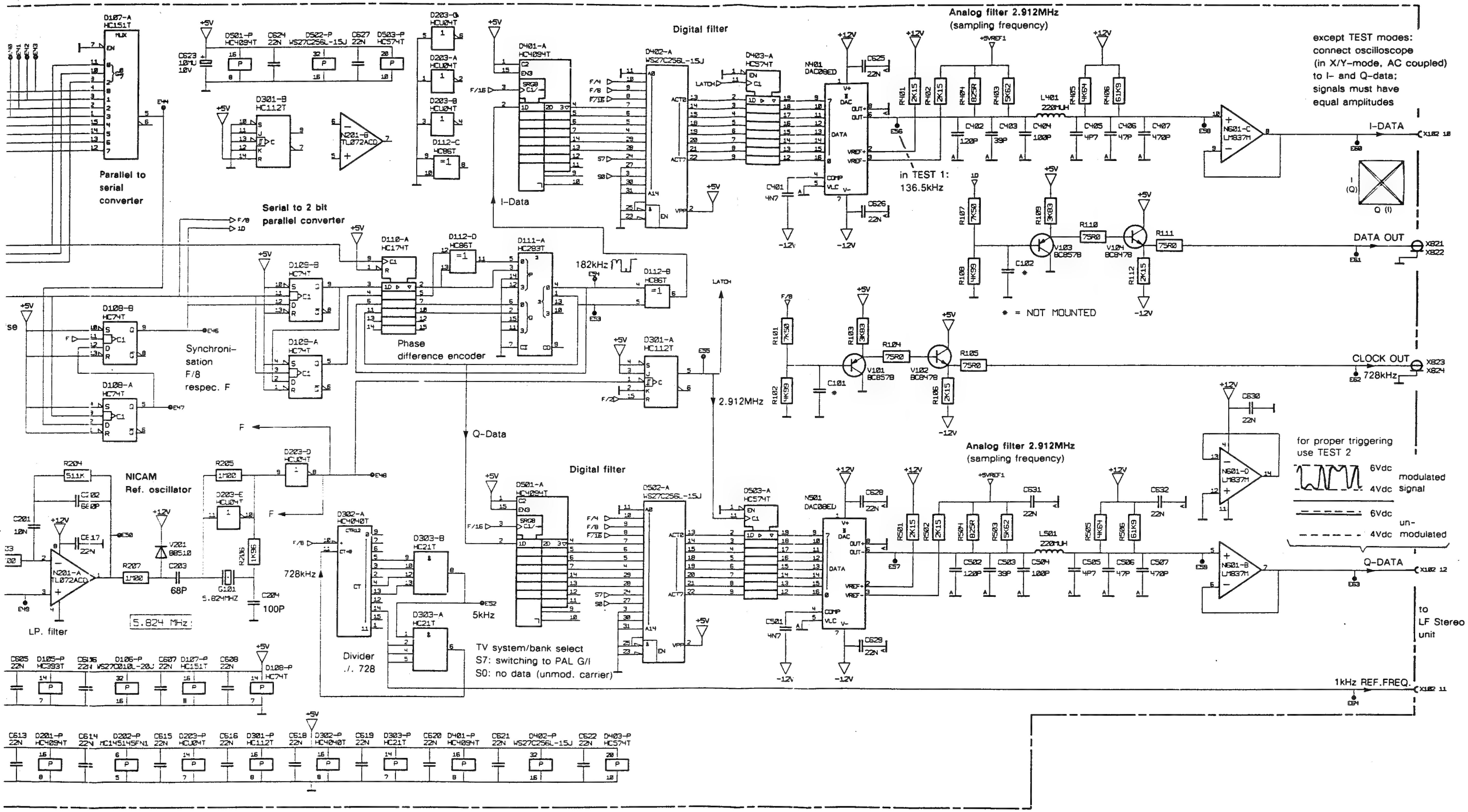


Fig. 141 Unit 7/TWIN, TWIN LF Unit

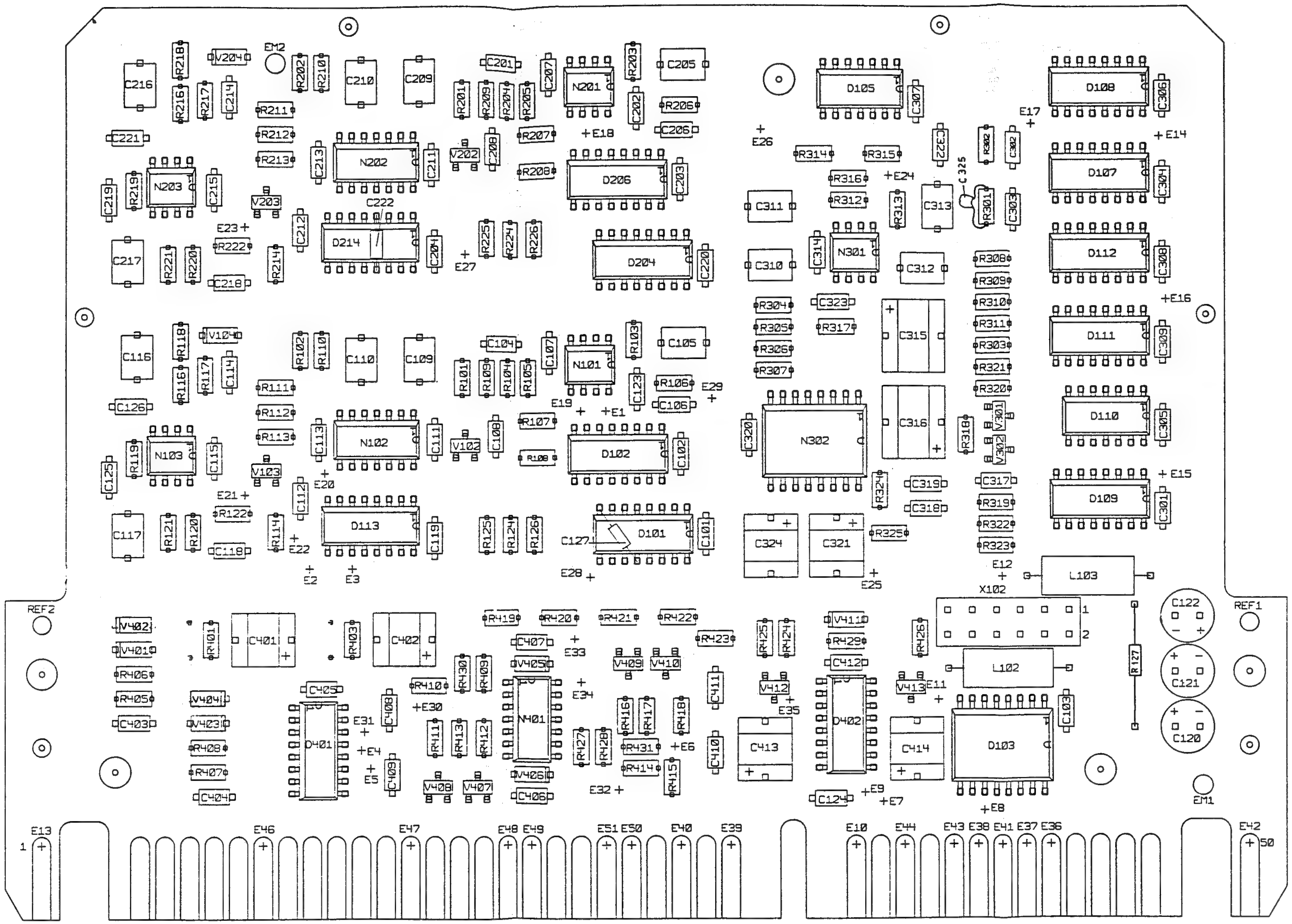


Fig. 142 Unit 7/TWIN, TWIN LF Unit

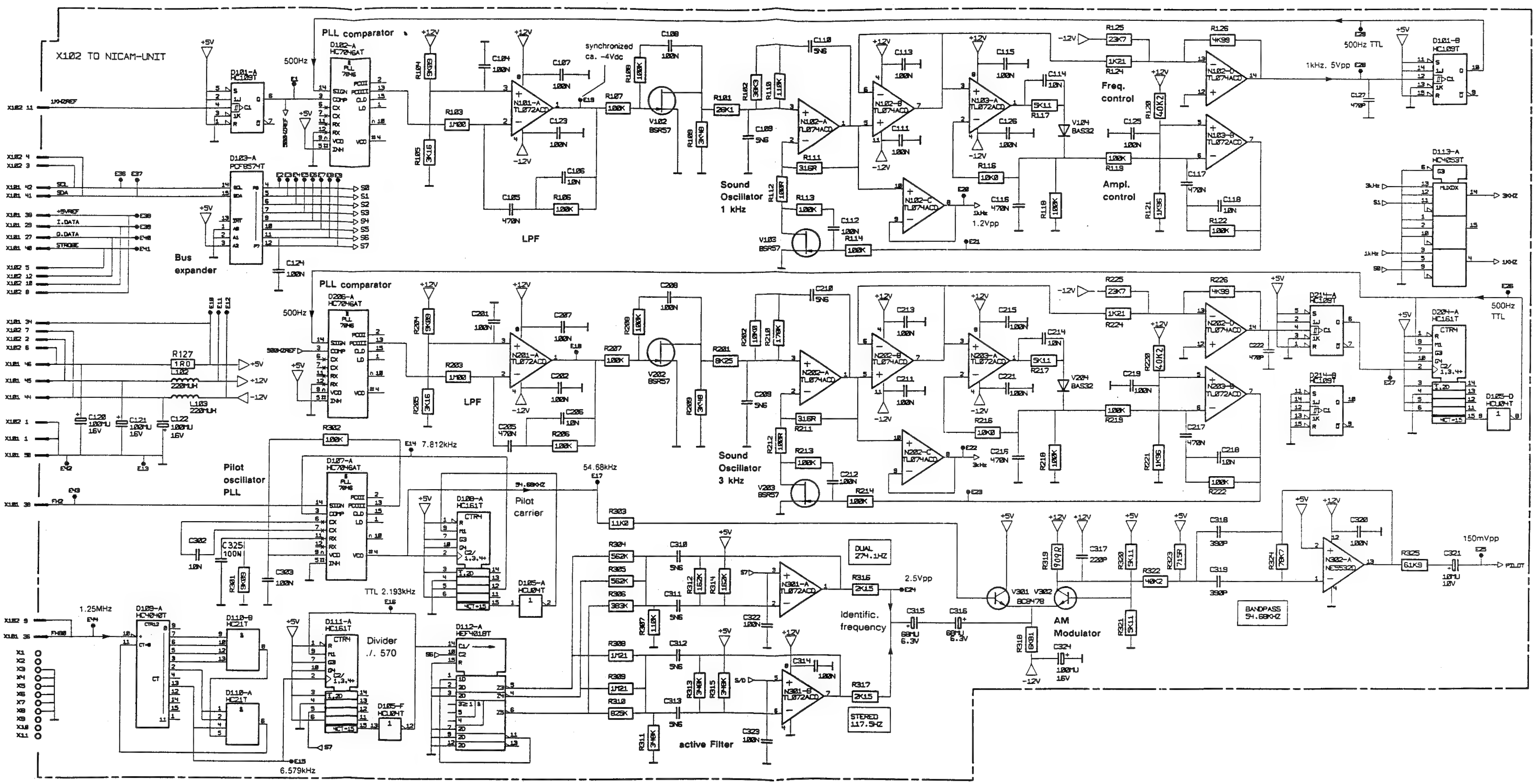


Fig. 143 Unit 7/TWIN, TWIN LF Unit, Part 1

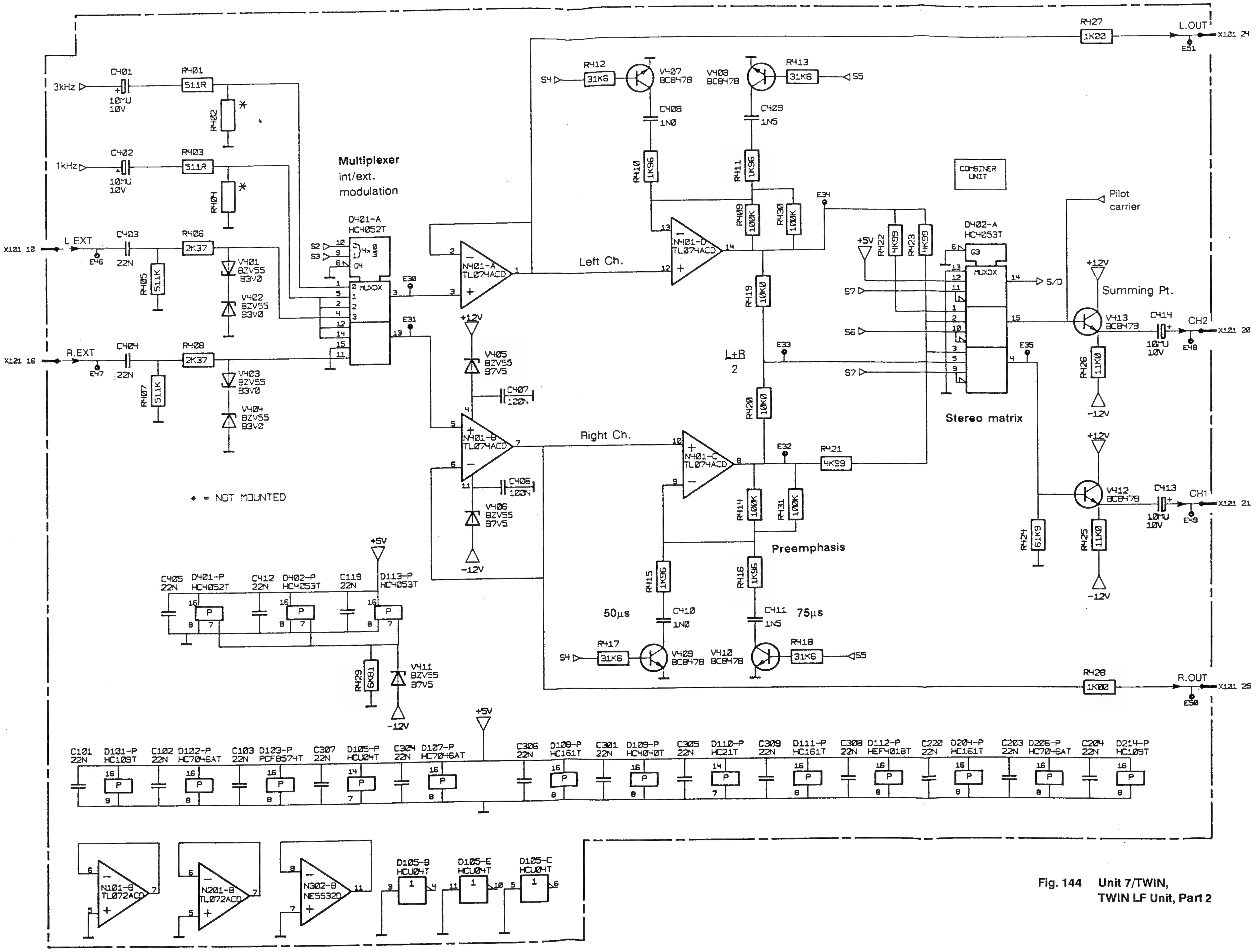


Fig. 144 Unit 7/TWIN, TWIN LF Unit, Part 2

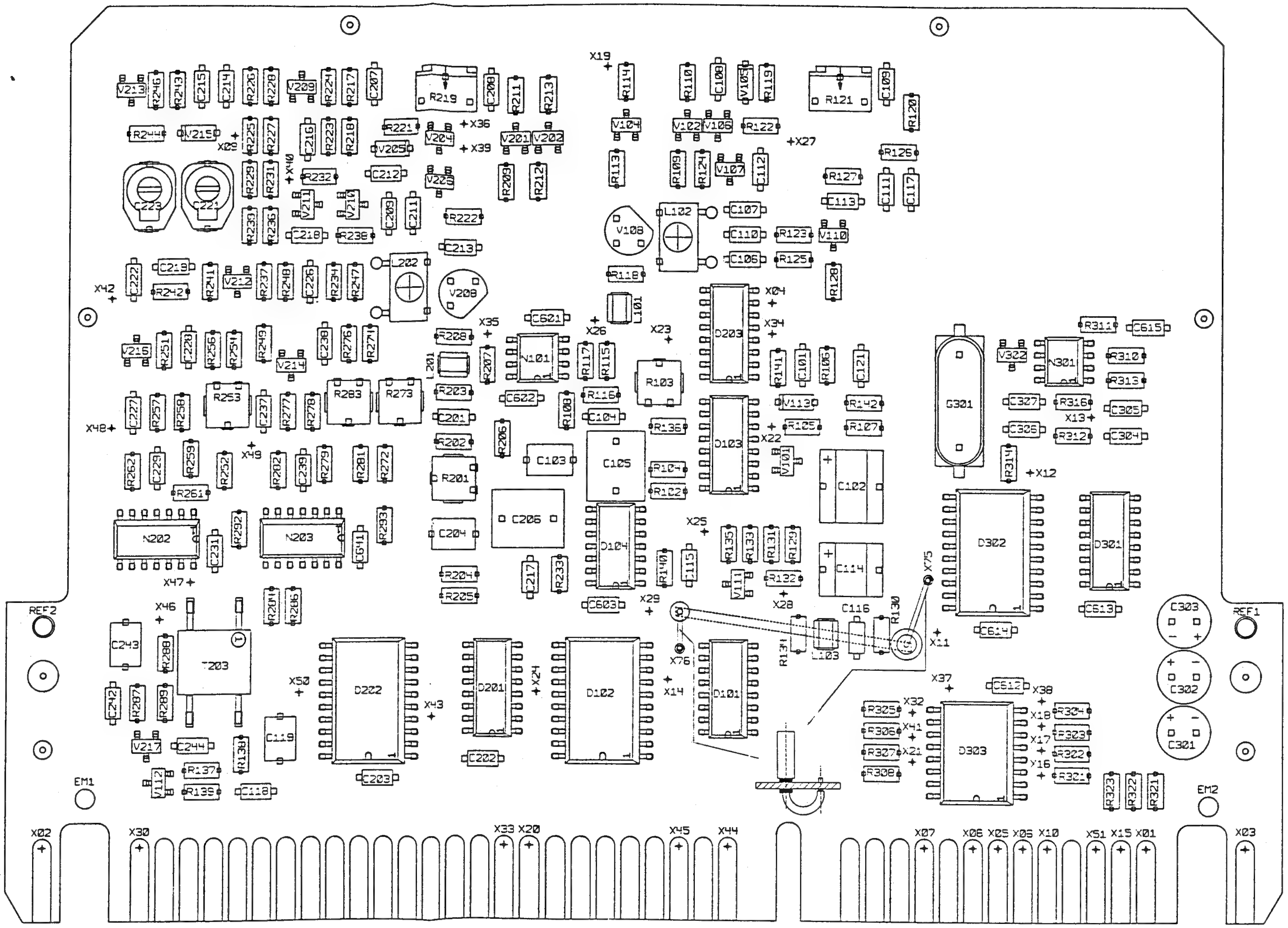
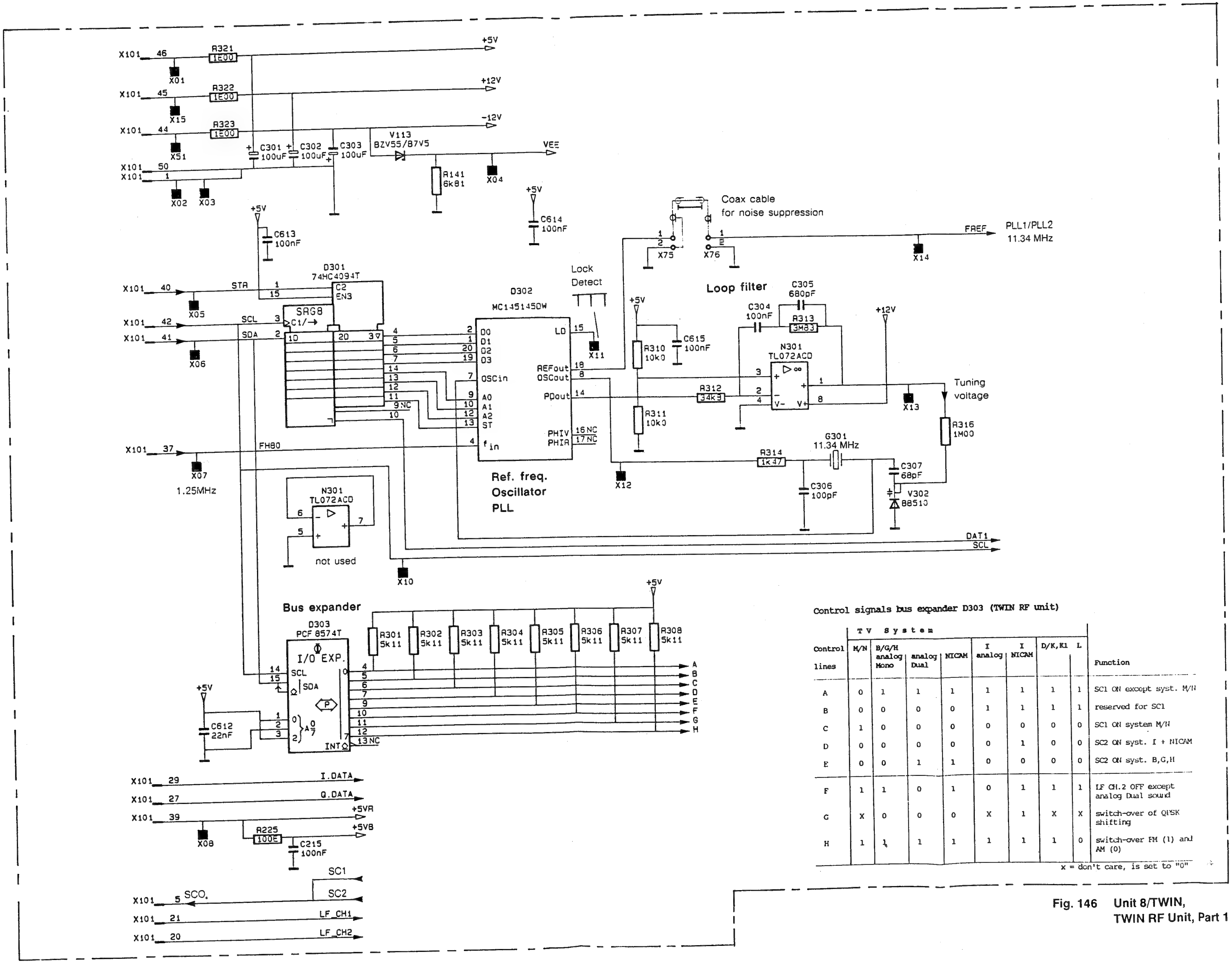


Fig. 145 Unit 8/TWIN, TWIN RF Unit



Control signals bus expander D303 (TWIN RF unit)

Control lines	TV System: M/N	B/G/H analog Mono	analog Dual	NICAM	I analog	I NICAM	D/K,K1	L	Function
A	0	1	1	1	1	1	1	1	SC1 ON except syst. M/N
B	0	0	0	0	1	1	1	1	reserved for SC1
C	1	0	0	0	0	0	0	0	SC1 ON system M/N
D	0	0	0	0	0	1	0	0	SC2 ON syst. I + NICAM
E	0	0	1	1	0	0	0	0	SC2 ON syst. B,G,H
F	1	1	0	1	0	1	1	1	LF CH.2 OFF except analog Dual sound
G	X	0	0	0	X	1	X	X	switch-over of QPSK shifting
H	1	1	1	1	1	1	1	0	switch-over FM (1) and AM (0)

x = don't care, is set to "0"

Fig. 146 Unit 8/TWIN, TWIN RF Unit, Part 1

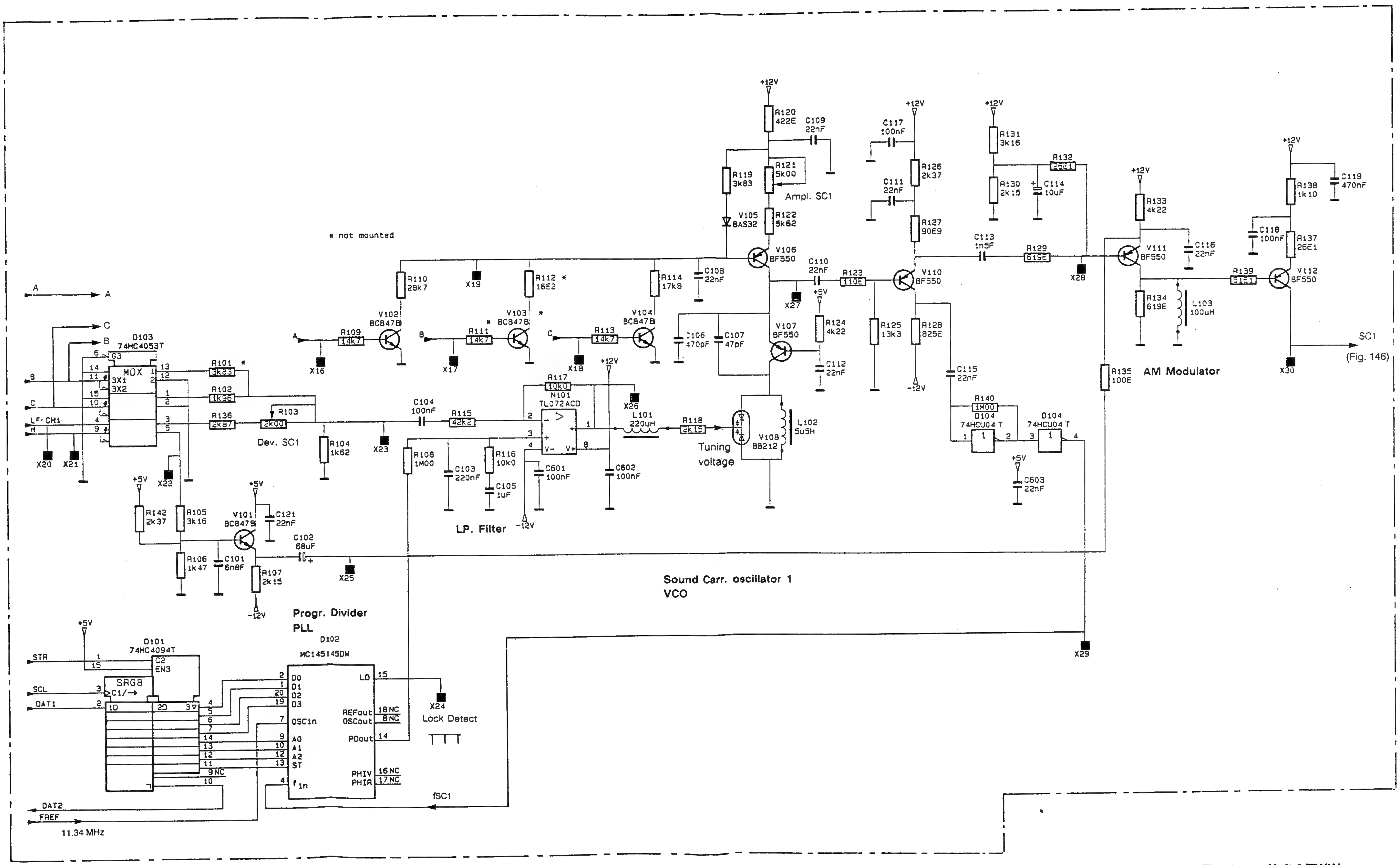


Fig. 147 Unit 8/TWIN,
TWIN RF Unit, Part 2

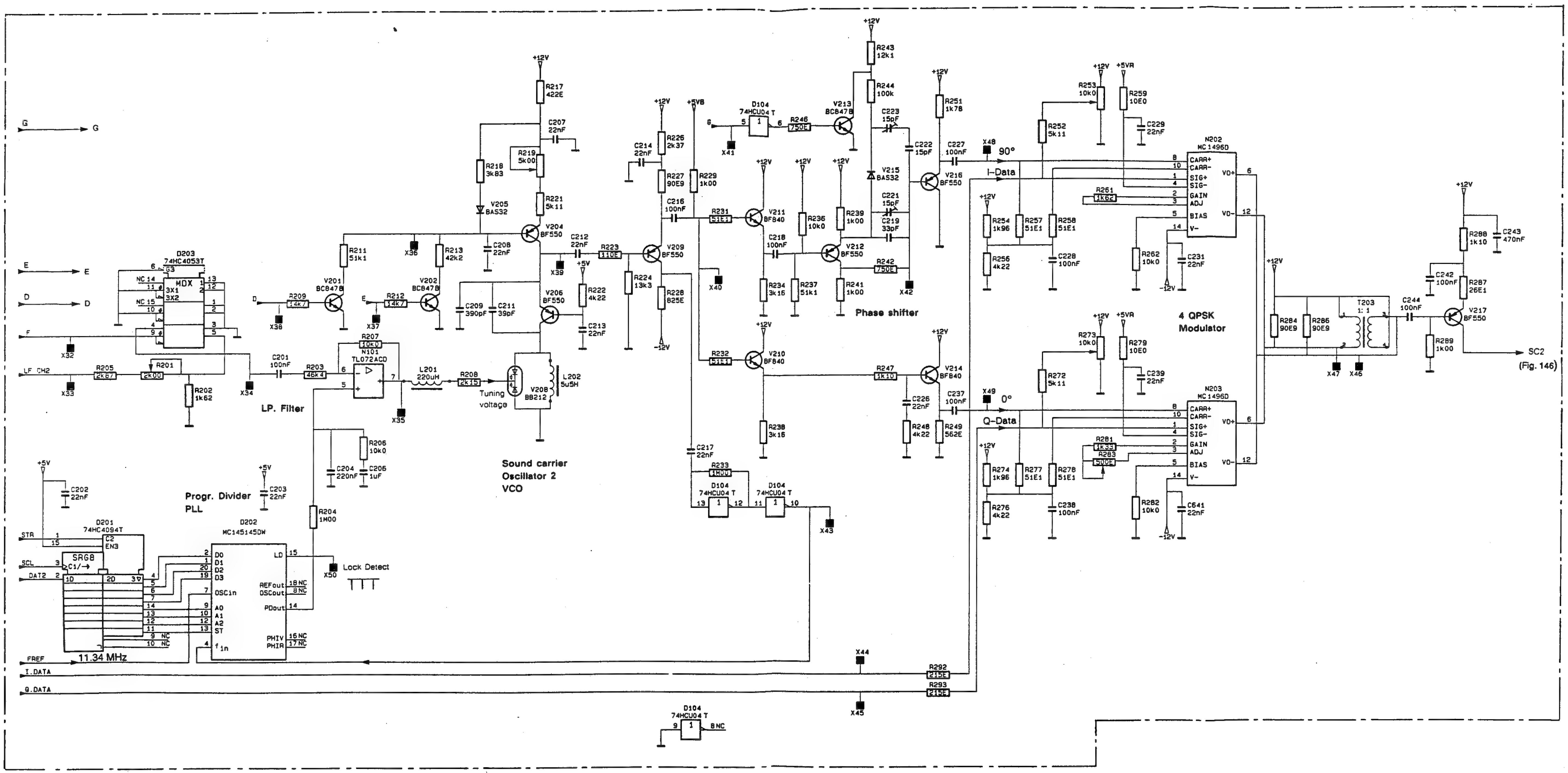
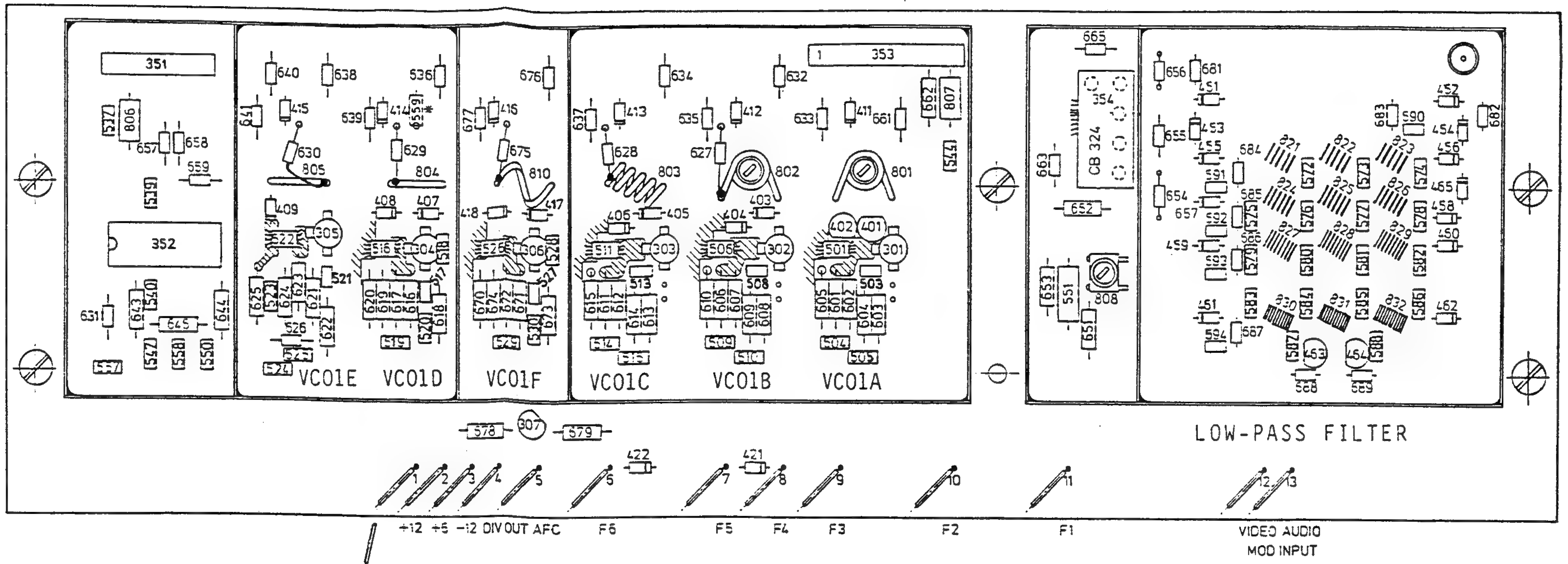
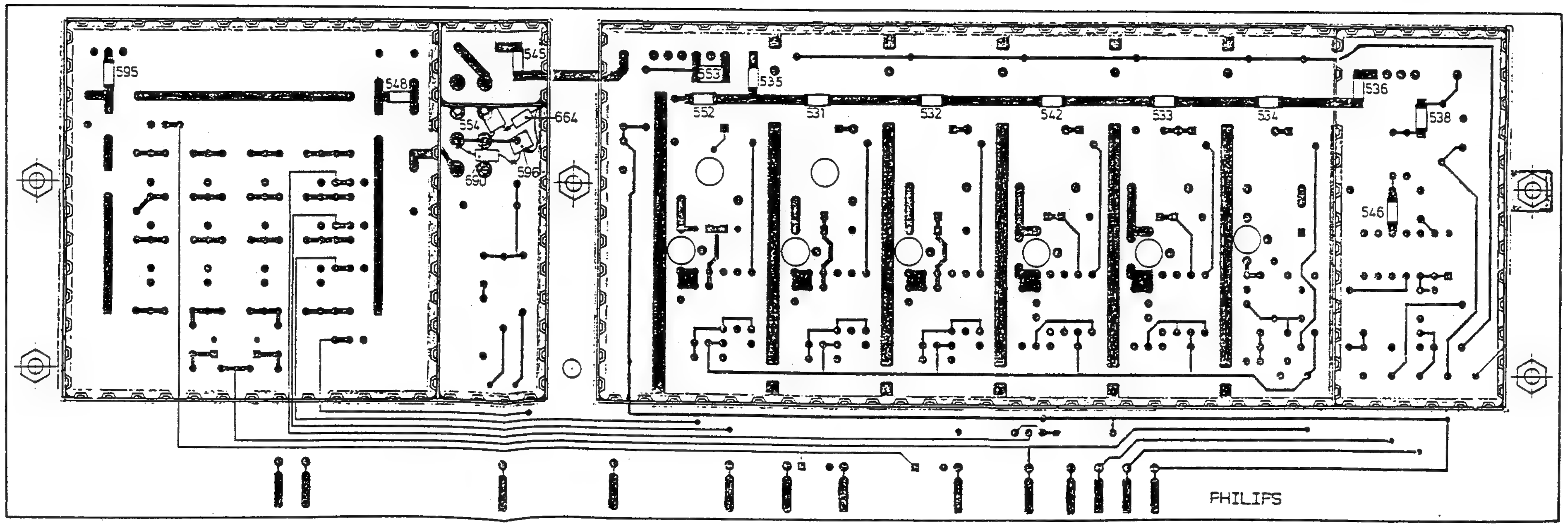


Fig. 148 Unit 8/TWIN,
TWIN RF Unit, Part 3



Pos.301...306

Pos. 501, 506, 511, 516, 522, 526:
use only special solder tin with silver.



For chip components (e.g. pos. 531)
use only special tin with silver.

Fig. 149 Unit 10, RF Unit

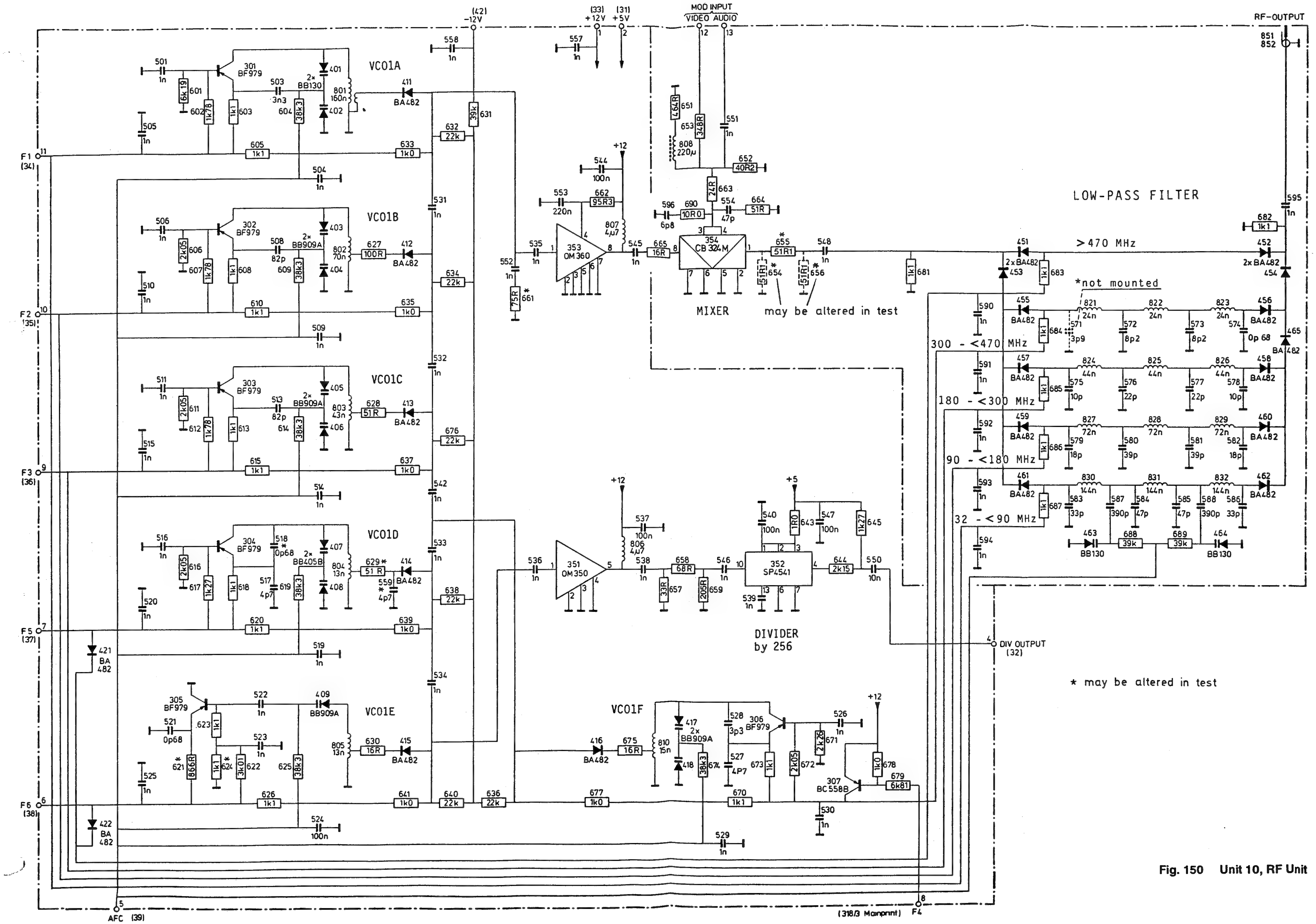


Fig. 150 Unit 10, RF Unit

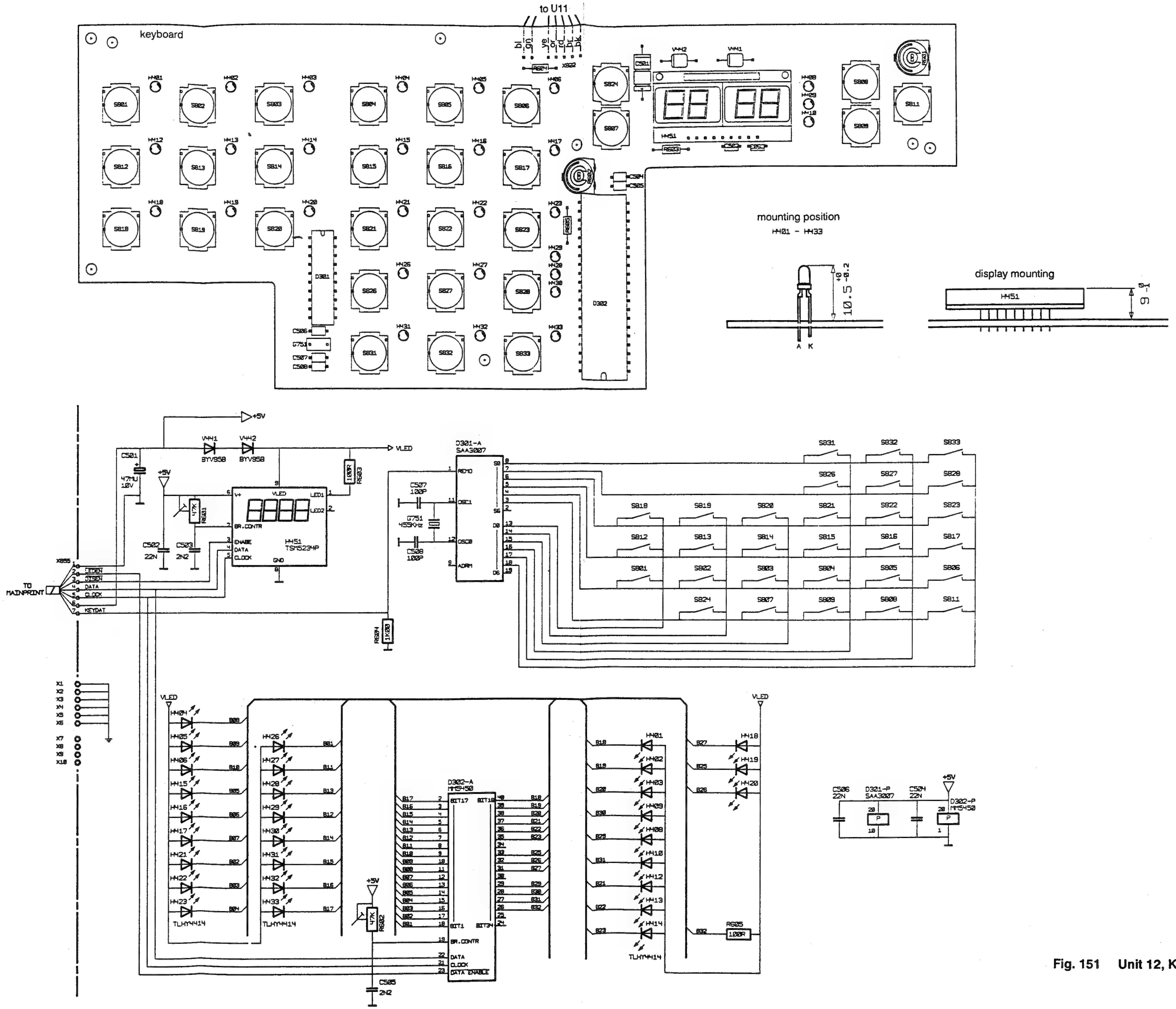


Fig. 151 Unit 12, Keyboard Unit

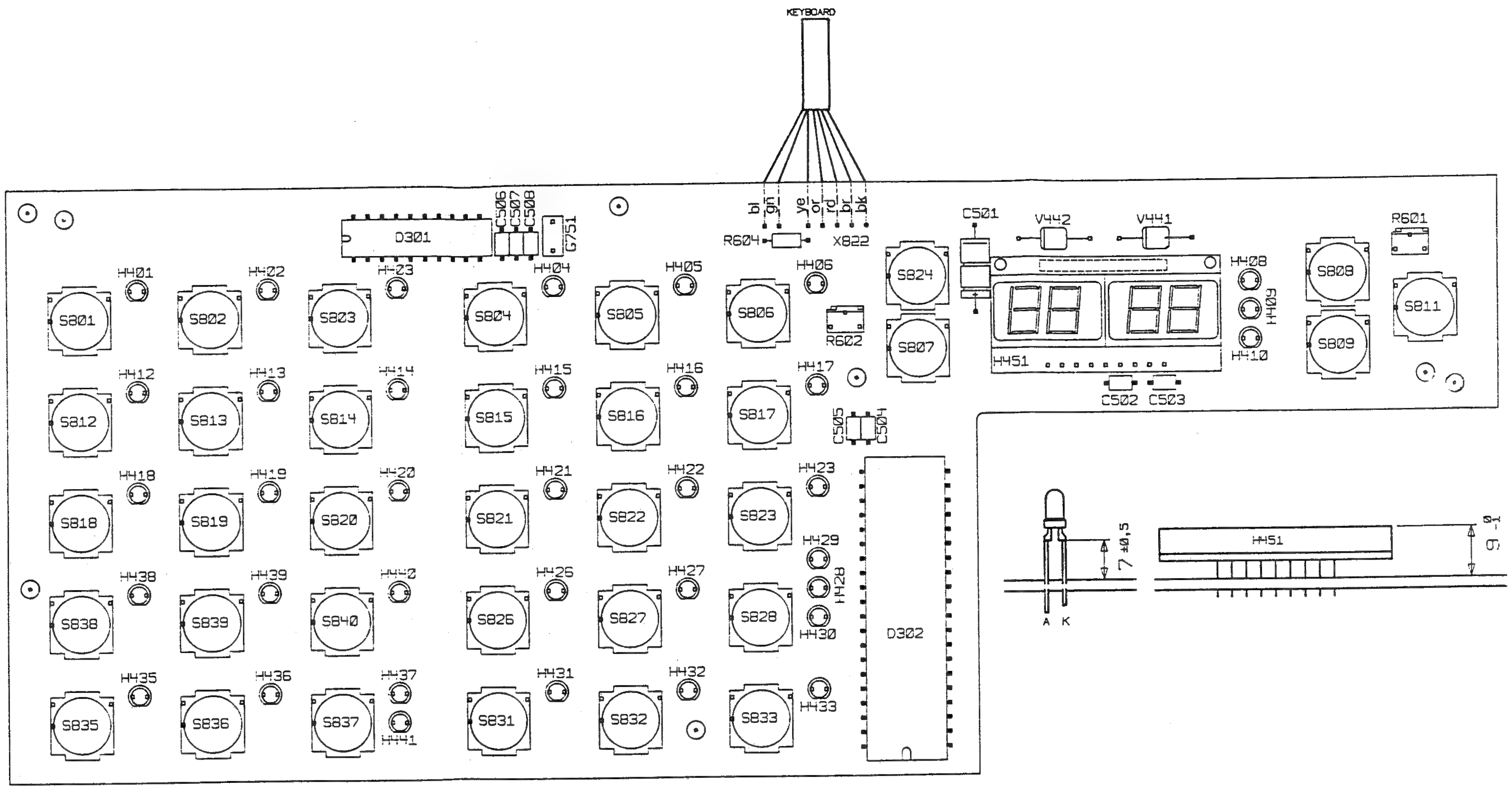


Fig. 152 **Unit 12/N,**
Keyboard Unit NICAM

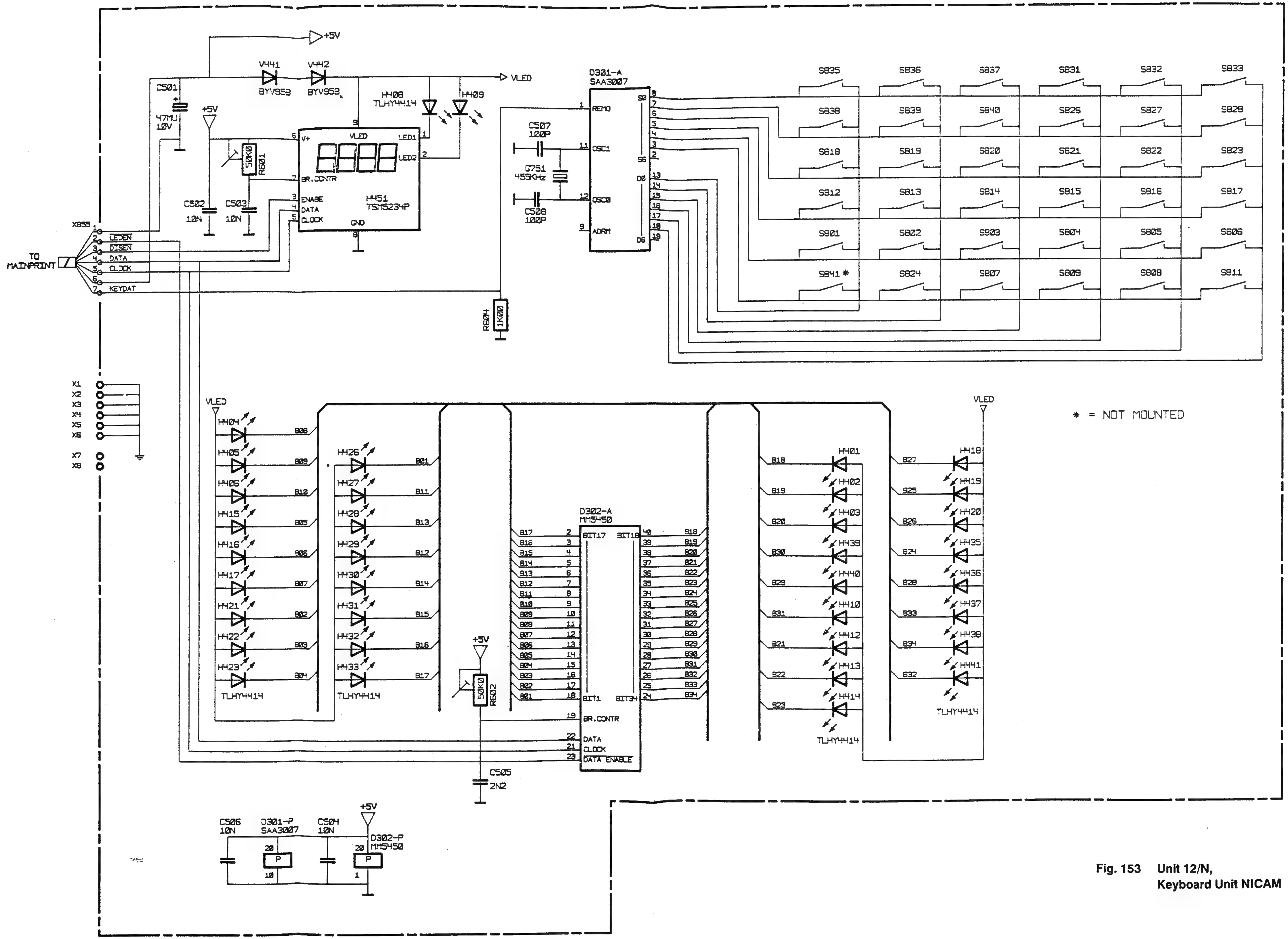


Fig. 153 Unit 12/N, Keyboard Unit NICAM

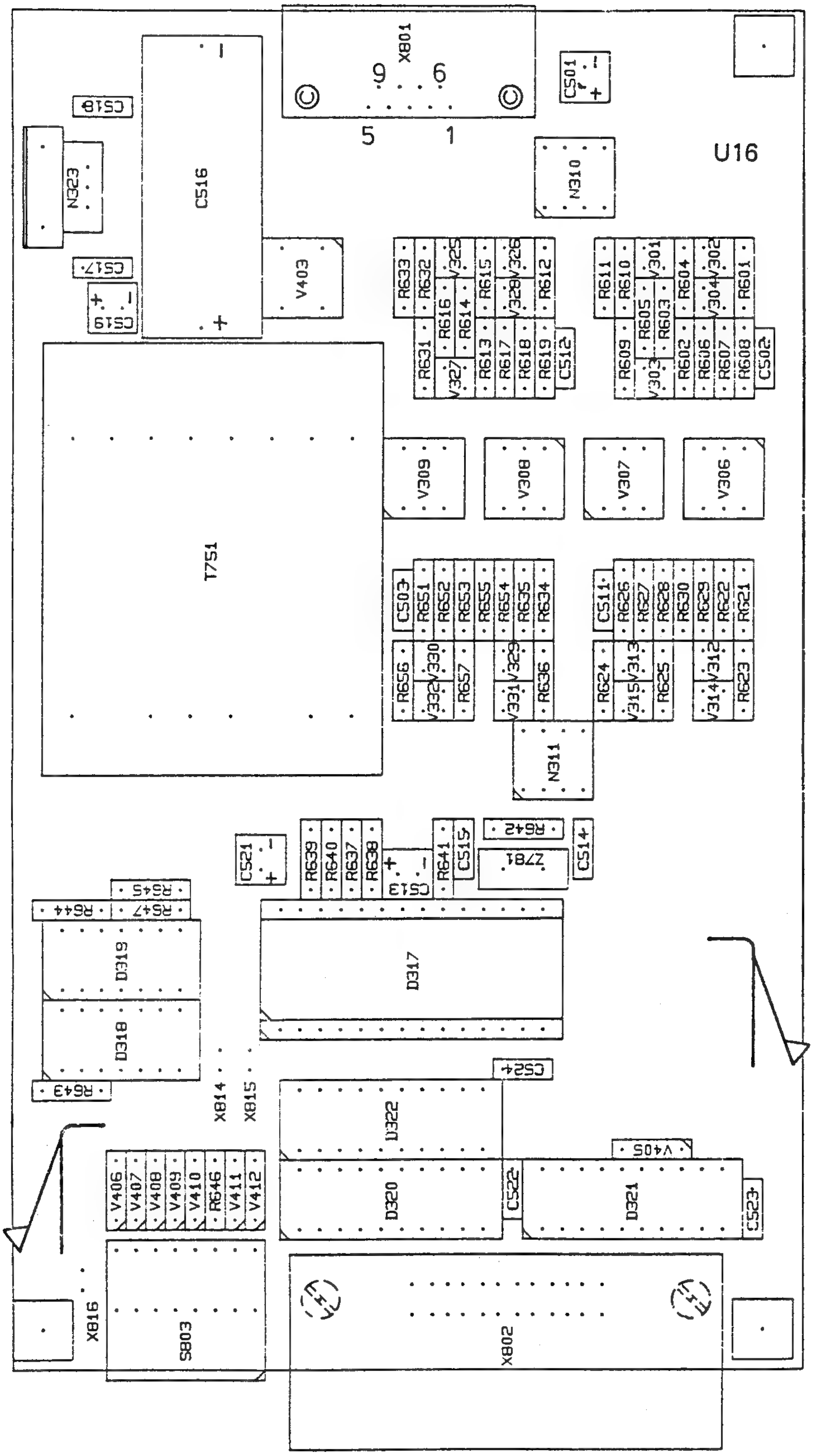


Fig. 154 Unit 13, IEEE-BUS Unit

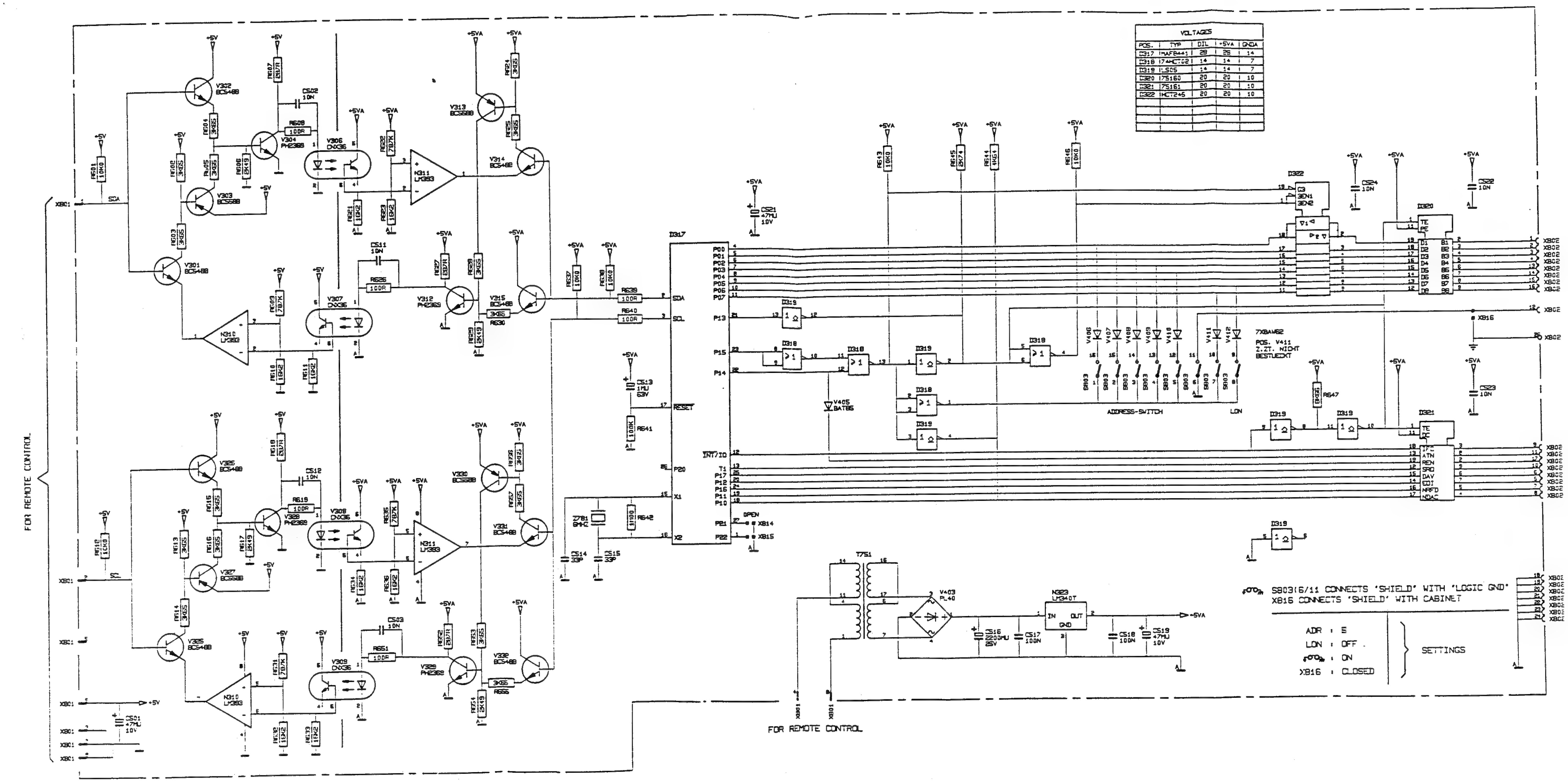
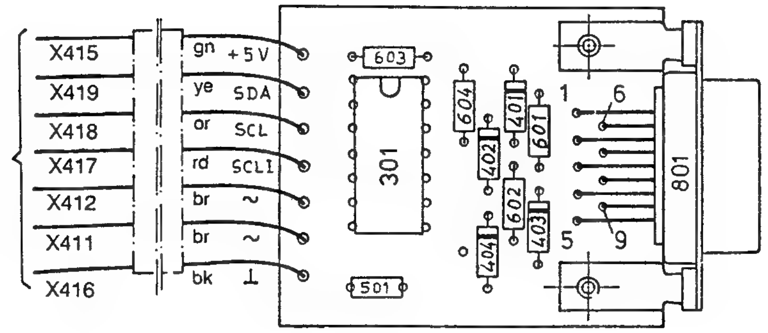


Fig. 155 Unit 13, IEEE-BUS Unit



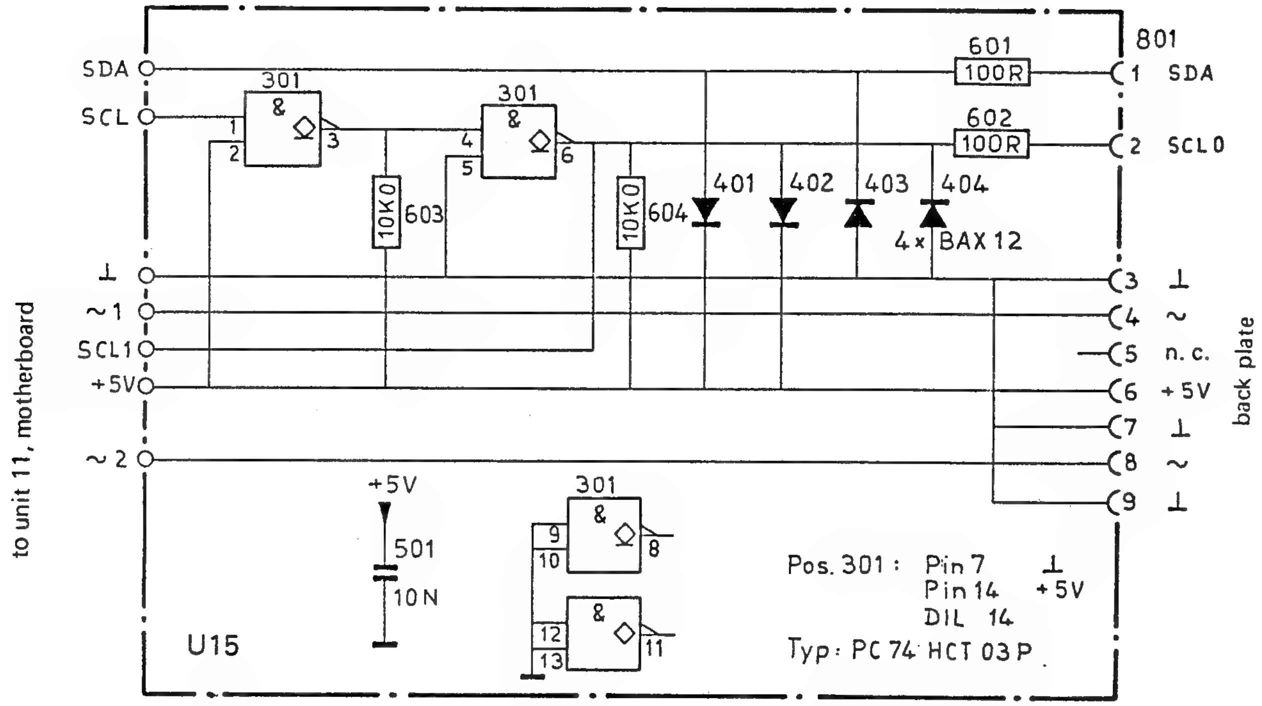


Fig. 156 Unit 13 A, I²C-BUS Adapter

APPENDIX

Level/Voltage Conversion

Data Sheets of Integrated Circuits:
SAA3007, SAA1043, SAA1044, SAB3036, TDA2501, TDA2506, TDA2507

Level/Voltage Conversion

In the application area of TV and antenna systems mostly 75 Ω technique is used.

Reference voltage: Eo = 1 µV at 75 Ω = 0 dBµV

LEVEL / VOLTAGE

Voltage µV at 75 Ω	Level dBµV	Voltage µV at 75 Ω	Level dBµV	Voltage mV at 75 Ω	Level dBµV	Voltage mV at 75 Ω	Level dBµV
1	0	50	34	1	60	50	94
1.5	3.5	60	35.5	1.5	63.5	60	95.5
2	6	70	37	2	66	70	97
2.5	8.0	80	38	2.5	68	80	98
3	9.5	90	39	3	69.5	90	99
3.5	11			3.5	71		
4	12	100	40	4	72	100	100
4.5	13	150	43.5	4.5	73	150	103.5
		200	46			200	106
5	14	250	48	5	74	250	108
6	15.5	300	49.5	6	75.5	300	109.5
7	17	350	51	7	77	350	111
8	18	400	52	8	78	400	112
9	19	450	53	9	79	450	113
10	20	500	54	10	80	500	114
15	23.5	600	55.5	15	83.5	600	115.5
20	26	700	57	20	86	700	117
25	28	800	58	25	88	800	118
30	29.5	900	59	30	89.5	900	119
35	31	1000	60	35	91	1000	120
40	32			40	92		
45	33			45	93		

dB/VOLTAGE RATIO

–	<---- dB ---->	+	–	<---- dB ---->	+	–	<---- dB ---->	+
1.0	0.0	1.0	0.32	10	3.16	0.032	30	31.6
0.94	0.5	1.06	0.28	11	3.55	0.028	31	35.5
0.89	1	1.12	0.25	12	4.0	0.025	32	40
0.84	1.5	1.19	0.22	13	4.5	0.022	33	45
0.8	2	1.25	0.2	14	5.0	0.02	34	50
0.75	2.5	1.33	0.18	15	5.62	0.018	35	56
0.71	3	1.41	0.16	16	6.3	0.016	36	63
0.67	3.5	1.5	0.14	17	7.1	0.014	37	71
0.63	4	1.6	0.125	18	8.0	0.0125	38	80
0.6	4.5	1.67	0.11	19	8.9	0.011	39	89
0.56	5	1.78	0.10	20	10.0	0.010	40	100
0.53	5.5	1.88	0.089	21	11.2	0.0056	41	178
0.5	6	2.0	0.08	22	12.5	0.0032	50	316
0.47	6.5	2.12	0.071	23	14.1	0.0018	55	562
0.45	7	2.24	0.063	24	16.0	0.001	60	1000
0.42	7.5	2.37	0.056	25	17.8			
0.4	8	2.5	0.05	26	20.0			
0.38	8.5	2.66	0.045	27	22.4			
0.35	9	2.82	0.04	28	25.0			
0.33	9.5	3.0	0.035	29	28.2			

FOR DETAILED INFORMATION SEE RELEVANT DATA BOOK OR DATA SHEET

INFRARED REMOTE CONTROL TRANSMITTER (LOW VOLTAGE)

GENERAL DESCRIPTION

The SAA3007 transmitter IC for infrared remote control systems has a capacity for 1280 commands arranged in 20 subsystem address groups of 64 commands each. The subsystem address may be selected by press-button or slider switches, or be hard-wired.

Commands are transmitted in patterns of pulses coded by the pulse spacing. The pulses can be infrared flashed (single pulse) or modulated. Flashed infrared transmissions require a wideband preamplifier at the receiver, but modulated transmissions allow a narrow band receiver to be used for improved noise rejection. The modulation frequency of the SAA3007 is 455 kHz which allows disturbance-free infrared operation in the presence of 10 - 100 kHz fluorescent lamps.

Features

- Flashed or modulated transmission modes
- Immune from fluorescent lamp disturbance in modulated mode
- Supply voltage range 2 V to 6,5 V
- 40 mA output current capability
- Very low standby current (< 4 μA at V_{DD} = 6 V)
- Up to 20 subsystem address groups } up to 1280 commands
- Up to 64 commands per subsystem address }
- Requires few additional components

PACKAGE OUTLINES

SAA3007P: 20-lead DIL; plastic (SOT-146C1).

SAA3007

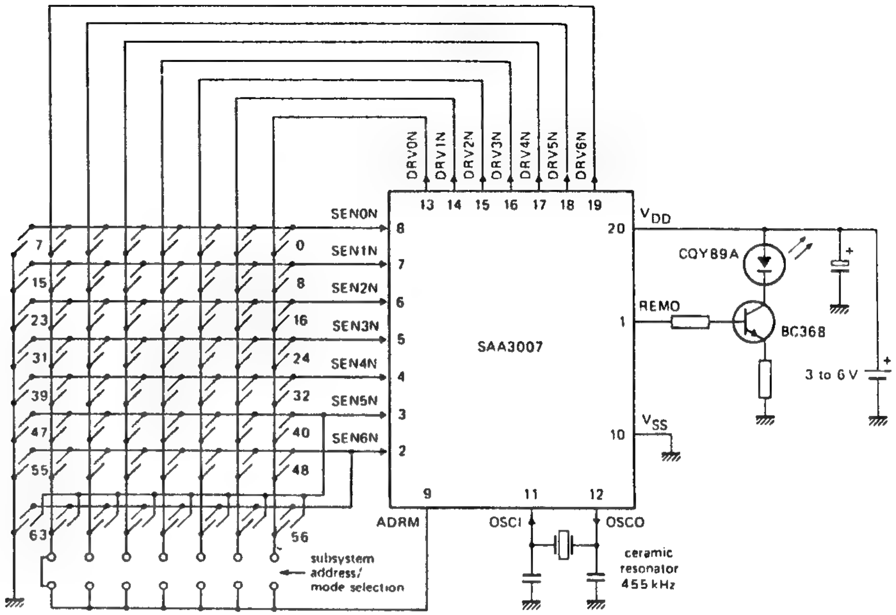


Fig. 1 SAA3007 application example.

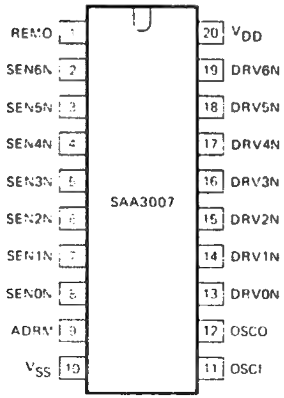


Fig. 2 Pinning diagram.

PINNING

1.	REMO	remote data output
2.	SEN6N	
3.	SEN5N	
4.	SEN4N	
5.	SEN3N	sense inputs from key matrix
6.	SEN2N	
7.	SEN1N	
8.	SEN0N	
9.	ADRM	address/mode control input
10.	V_{SS}	ground (0 V)
11.	OSCI	oscillator input
12.	OSCO	oscillator output
13.	DRV0N	
14.	DRV1N	
15.	DRV2N	
16.	DRV3N	drive outputs to key matrix
17.	DRV4N	
18.	DRV5N	
19.	DRV6N	
20.	V_{DD}	positive supply voltage

PINNING

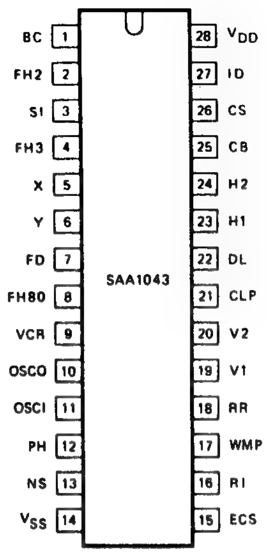


Fig. 2 Pinning diagram.

1	BC	burst flag/chroma blanking (SECAM) output
2	FH2	PAL identification output
3	SI	set identification input (SECAM, PAL, PAL-M)
4	FH3	400 Hz (PAL); 360 HZ (NTSC, PAL-M) and $f_H/3$ (SECAM)
5	X	standard programming input
6	Y	standard programming input
7	FD	standard programming input
8	FH80	80 x f_H output (1,25 MHz)
9	VCR	VCR standard input
10	OSCO	oscillator output
11	OSCI	oscillator input
12	PH	phase detector output
13	NS	no-sync detector output
14	V_{SS}	negative supply voltage (ground)
15	ECS	external composite sync input
16	RI	vertical identification output
17	WMP	white measurement pulse output
18	RR	vertical reset input
19	V1	vertical drive output
20	V2	vertical drive output
21	CLP	clamp pulse output
22	DL	2 x f_H input/output
23	H1	horizontal drive output
24	H2	horizontal drive output
25	CB	composite blanking output
26	CS	composite sync output
27	ID	SECAM identification output
28	V_{DD}	positive supply voltage

UNIVERSAL SYNC GENERATOR

GENERAL DESCRIPTION

The SAA1043 generates the synchronizing waveforms required in all types of video source equipment (video cameras, film-scanners, video games, computer displays and similar applications). The device is programmable to suit standards SECAM 1, SECAM 2, PAL/CCIR, NTSC 1, NTSC 2, and PAL-M; the video game 624 and 524-line standards; and can be synchronized to an external sync signal. Inputs and outputs are CMOS compatible.

Features

- Programmable to eight standards
- Horizontal frequency manipulation for application in non-standard systems
- Oscillator functions with LC or crystal elements
- Additional outputs to simplify camera signal processing
- Can be synchronized to an external sync signal
- Vertical reset for fast vertical lock
- Subcarrier lock in combination with subcarrier coupler SAA1044
- Very low power consumption

QUICK REFERENCE DATA

Supply voltage range (pin 28)	V_{DD}		5,7 to 7,5 V
Supply current (quiescent)	I_{DD}	max.	10 μA
Oscillator frequency	f_{OSCI}	max.	5,1 MHz

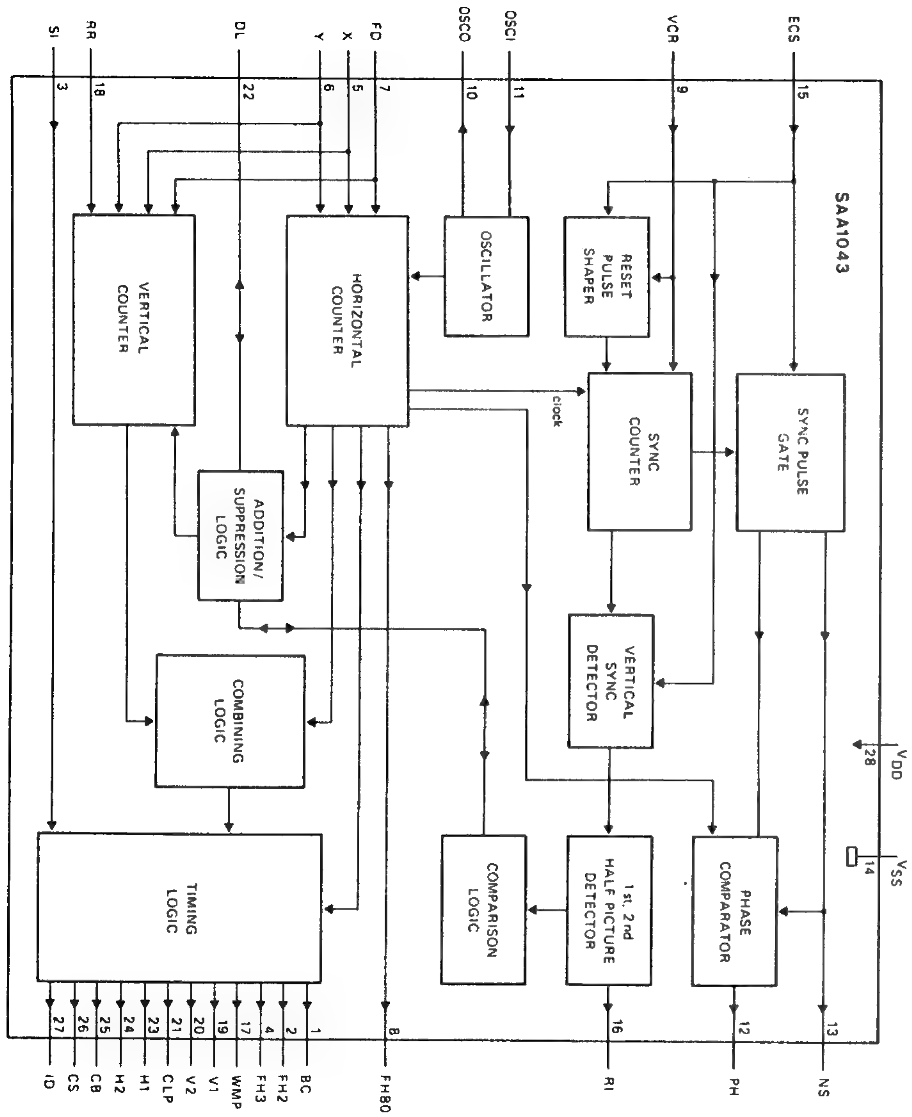


Fig. 1 Block diagram.

FUNCTIONAL DESCRIPTION

Sync pulse generation

Programming of operating standard

The standard required for operation is programmed using the inputs X, Y and FD as shown in Table 1. The FD input selects 525 or 625-line working of the vertical counter (524 or 624-lines for video game standards) and also influences the choice of oscillator frequency as shown in Table 2.

Table 1 Programming of operating standard

standard	FD	X	Y
SECAM 1	0	0	0
SECAM 2	0	0	1
624	0	1	0
PAL/CCIR	0	1	1
NTSC 1	1	0	0
NTSC 2	1	0	1
524	1	1	0
PAL-M	1	1	1

positive logic: 1 = HIGH; 0 = LOW

Oscillator

The built-in oscillator of the SAA1043 functions with an external LC-circuit (Fig. 3) or with a crystal of the parallel resonance type (Fig. 4). For operation in the VCR mode the LC oscillator circuit is recommended. The frequencies required for the operating standards are shown in Table 2.

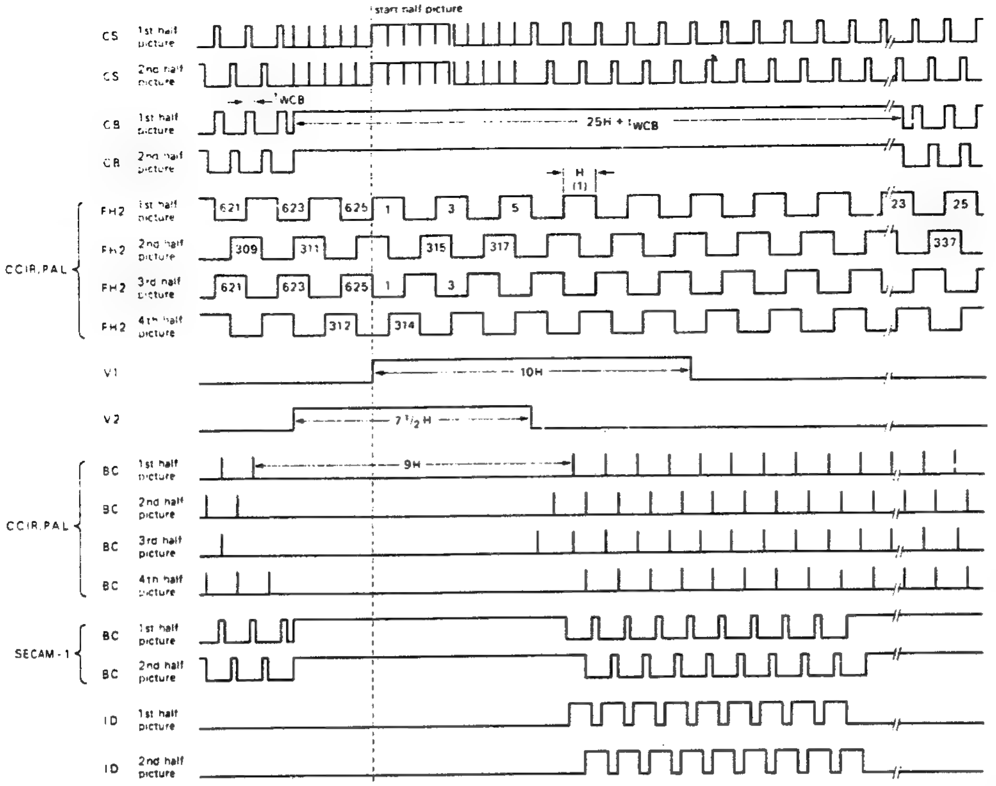
Table 2 Oscillator input frequencies

operating standard	osc. frequency (f_{OSCI}) MHz	vertical divider (FD)	vertical frequency (f_V) Hz	horizontal frequency (f_H) Hz
PAL, SECAM, 624	5,0	0	50	15625
NTSC, PAL-M, 524	5,034964	1	59,94	15734,26
PAL, SECAM, 624	2,5	H2 (pin 24)	50	15625
NTSC, PAL-M, 524	2,501748	H1 (pin 23)	59,94	15734,26

Universal sync generator

Output waveforms

The output waveforms for the different modes of operation are shown in Figs 7 and 8.

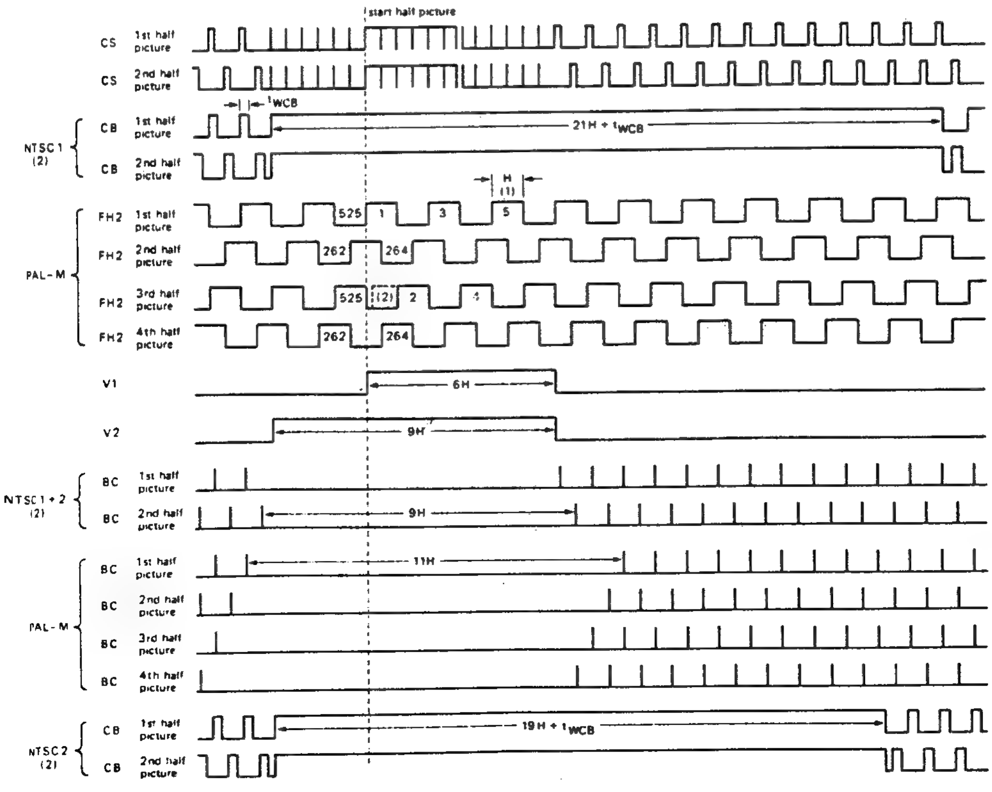


(1) H = 1 horizontal scan.

Fig. 7 Typical output waveforms for PAL/CCIR and SECAM. In the 624-line mode the output waveforms are identical to the 1st half picture of PAL/CCIR and are not interlaced (0,5H subtracted from the waveform timing).

FUNCTIONAL DESCRIPTION (continued)

Output waveforms (continued)



(1) H = 1 horizontal scan.

(2) NTSC mode reset; the 4th half picture is identical to the 2nd half picture for NTSC.

Fig. 8 Typical output waveforms for NTSC and PAL-M. In the 524-line mode the output waveforms are identical to the 1st half picture of NTSC and are not interlaced (0,5H subtracted from the waveform timing).

SUBCARRIER COUPLER

GENERAL DESCRIPTION

The SAA1044 maintains the correct relationship between subcarrier and horizontal scan frequencies when an exact coupling is required. It is for use in combination with sync generator SAA1043 for application in colour video sources (cameras, film-scanners and similar equipments).

Features

- Provides exact relationship between subcarrier and horizontal scan frequencies
- Accommodates all standard frequencies
- Facilitates GENLOCK (general locking) applications

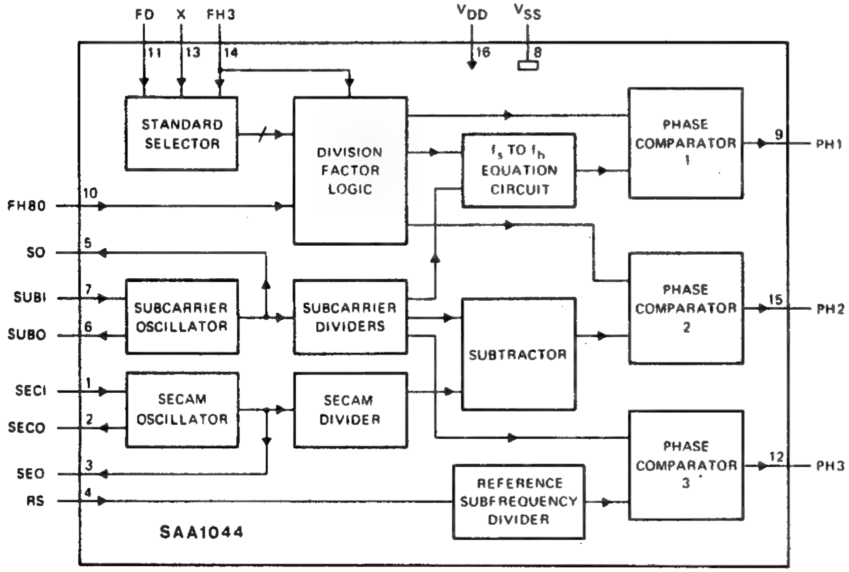


Fig. 1 Block diagram.

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

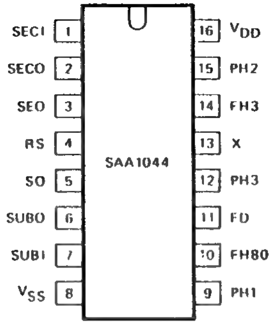


Fig. 2 Pinning diagram.

PINNING

1	SECI	SECAM oscillator input ($272f_H$)
2	SECO	SECAM oscillator output ($272f_H$)
3	SEO	inverted SECAM oscillator output
4	RS	reference subfrequency
5	SO	inverted subcarrier oscillator output
6	SUBO	subcarrier oscillator output
7	SUBI	subcarrier oscillator input
8	V_{SS}	negative supply voltage (ground)
9	PH1	phase comparator 1 output (FH80/SUBI)
10	FH80	1,25 MHz input (from SAA1043)
11	FD	standard programming input
12	PH3	phase comparator 3 output (RS/SUBI)
13	X	standard programming input
14	FH3	standard programming input (from SAA1043)
15	PH2	phase comparator 2 output (SECI/FH80)
16	V_{DD}	positive supply voltage

FUNCTIONAL DESCRIPTION

Programming of operating standard

The standard required for operation is programmed using the inputs FD, X and FH3 as shown in Table 1.

Table 1 Programming of operating standard

standard	FD	X	FH3	relationship of subcarrier frequency (f_S) to horizontal scan frequency (f_H)
PAL	0	1	400 Hz	$f_S = 283{,}7516 f_H$
SECAM	0	0	don't care	$f_S = 282 f_H$
PAL-N	1	1	400 Hz	$f_S = 229{,}2516 f_H$
PAL-M	1	0	1	$f_S = 227{,}25 f_H$
NTSC	1	0	0	$f_S = 227{,}5 f_H$

Positive logic: 1 = HIGH; 0 = LOW

Subcarrier/horizontal scan frequency relationship

The input FH80 from SAA1043 is the reference for horizontal scan frequency (f_H). This frequency is reduced by a factor determined by the selected operating standard to give a value of $8f_H$ (PAL, SECAM) or $10f_H$ (PAL-N, PAL-M, NTSC) to phase comparator 1. The subcarrier frequency (f_S) is manipulated to provide a comparable value at the second input to the phase comparator. When the frequencies of the two inputs to phase comparator 1 are equal, the relationship between f_H and f_S is as shown in Table 1.

Phase comparator 1 functions with an exclusive-OR phase detector circuit and provides an output which may be used to control a voltage-controlled oscillator (VCO) via a low-pass filter. The VCO reference can be the subcarrier or the horizontal scan frequency and the filter can be active or passive, depending on application.

A second subcarrier oscillator circuit is provided for SECAM operation. The operating frequency of this is centred on $272f_H$ to give, when $f_S = 282f_H$, comparable values of $5f_H$ at the two inputs to phase comparator 2. A second VCO loop can be used to control the SECAM oscillator frequency.

The high degrees of accuracy and stability required for GENLOCK applications are met by phase comparator 3. This compares the internal subcarrier and external reference frequencies. To adjust the phase over 2π, this comparator has a linear characteristic over 4π. The output signal PH3 has a period time of $f_S/4$ and a duty cycle of between 12,5% and 62,5% giving a sensitivity of 240 mV/rad. Errors due to temperature variation are minimized by symmetrical circuit and chip design.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range with respect to V_{SS}	V_{DD}		−0,5 to + 15	V
Input voltage range	V_I		−0,5 to (V_{DD} + 0,5)*	V
Input current	$\pm I_I$	max.	10	mA
Output voltage range	V_O		−0,5 to (V_{DD} + 0,5)*	V
Output current	$\pm I_O$	max.	10	mA
Power dissipation per output	P_O	max.	100	mW
Total power dissipation per package	P_{tot}	max.	200	mW
Operating ambient temperature range	T_{amb}		−25 to + 70	°C
Storage temperature range	T_{stg}		−55 to + 150	°C

HANDLING

Inputs and outputs are protected against electrostatic charge in normal handling. However, to be totally safe, it is desirable to take normal precautions appropriate to handling MOS devices (see 'Handling MOS Devices').

* V_{DD} + 0,5 V not to exceed 15 V.

COMPUTER INTERFACE FOR TUNING AND CONTROL (CITAC)

GENERAL DESCRIPTION

The SAB3036 provides closed-loop digital tuning of TV receivers, with or without a.f.c., as required. It also controls 4 general purpose I/O ports and 4 high-current outputs for tuner band selection.

The IC is used in conjunction with a microcomputer from the MAB8400 family and is controlled via a two-wire, bidirectional I^2C bus.

Features

- Combined analogue and digital circuitry minimizes the number of additional interfacing components required
- Frequency measurement with resolution of 50 kHz
- Selectable prescaler divisor of 64 or 256
- 32 V tuning voltage amplifier
- 4 high-current outputs for direct band selection
- Four general purpose input/output (I/O) ports
- Tuning with control of speed and direction
- Tuning with or without a.f.c.
- Single-pin, 4 MHz on-chip oscillator
- I^2C bus slave transceiver

QUICK REFERENCE DATA

Supply voltages				
(pin 5)	V_{P1}	typ.	12	V
(pin 14)	V_{P2}	typ.	13	V
(pin 9)	V_{P3}	typ.	32	V
Supply currents (no outputs loaded)				
(pin 5)	I_{P1}	typ.	23	mA
(pin 14)	I_{P2}	typ.	0,1	mA
(pin 9)	I_{P3}	typ.	0,6	mA
Total power dissipation	P_{tot}	typ.	300	mW
Operating ambient temperature range	T_{amb}		−20 to + 70	°C

PACKAGE OUTLINE

18-lead DIL; plastic (SOT-102HE).

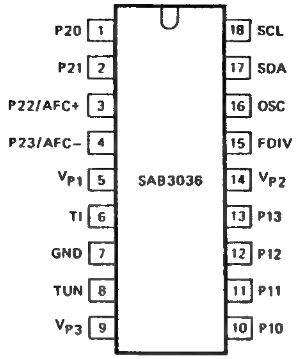


Fig. 2 Pinning diagram.

PINNING

1	P20	general purpose input/output ports
2	P21	
3	P22/AFC+	general purpose input/output ports and a.f.c. inputs
4	P23/AFC−	
5	V_{P1}	+ 12 V supply voltage
6	TI	tuning voltage amplifier inverting input
7	GND	ground
8	TUN	tuning voltage amplifier output
9	V_{P3}	+ 32 V supply for tuning voltage amplifier
10	P10	high-current band-selection output ports
11	P11	
12	P12	
13	P13	
14	V_{P2}	positive supply for high-current band-selection output circuits
15	FDIV	input from prescaler
16	OSC	crystal oscillator input
17	SDA	serial data line } I^2C bus
18	SCL	serial clock line } I^2C bus

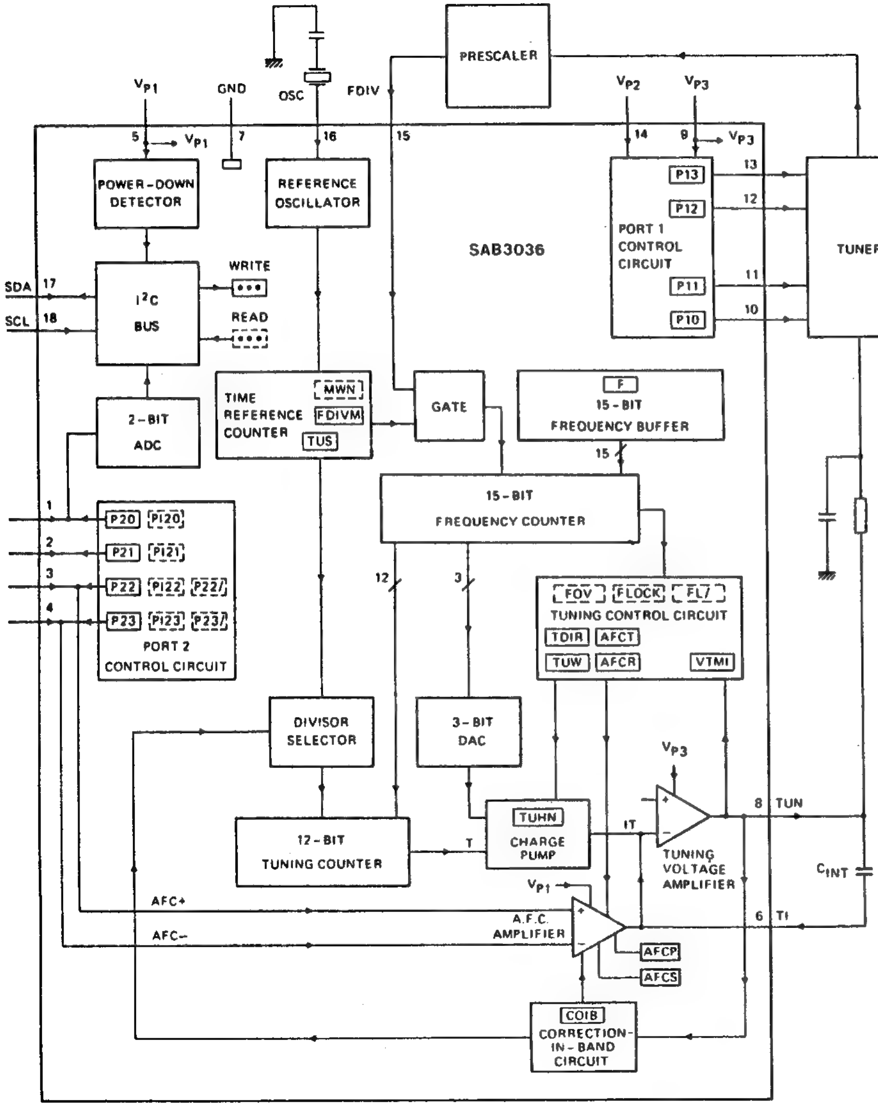


Fig. 1 Block diagram.

SAB3036

FUNCTIONAL DESCRIPTION

The SAB3036 is a monolithic computer interface which provides tuning and control functions and operates in conjunction with a microcomputer via an I^2C bus.

Tuning

This is performed using frequency-locked loop digital control. Data corresponding to the required tuner frequency is stored in a 15-bit frequency buffer. The actual tuner frequency, divided by a factor of 256 (or by 64) by a prescaler, is applied via a gate to a 15-bit frequency counter. This input (FDIV) is measured over a period controlled by a time reference counter and is compared with the contents of the frequency buffer. The result of the comparison is used to control the tuning voltage so that the tuner frequency equals the contents of the frequency buffer multiplied by 50 kHz within a programmable tuning window (TUW).

The system cycles over a period of 6,4 ms (or 2,56 ms), controlled by the time reference counter which is clocked by an on-chip 4 MHz reference oscillator. Regulation of the tuning voltage is performed by a charge pump frequency-locked loop system. The charge IT flowing into the tuning voltage amplifier is controlled by the tuning counter, 3-bit DAC and the charge pump circuit. The charge IT is linear with the frequency deviation Δf in steps of 50 kHz. For loop gain control, the relationship $\Delta IT/\Delta f$ is programmable. In the normal mode (when control bits TUHN0 and TUHN1 are both at logic 1, see OPERATION), the minimum charge IT at Δf = 50 kHz equals 250 μA μs (typical).

By programming the tuning sensitivity bits (TUS), the charge IT can be doubled up to 6 times. If correction-in-band (COIB) is programmed, the charge can be further doubled up to three times in relation to the tuning voltage level. From this, the maximum charge IT at Δf = 50 kHz equals $2^6 \times 2^3 \times 250$ μA μs (typical).

The maximum tuning current I is 875 μA (typical). In the tuning-hold (TUHN) mode (TUHN is active LOW), the tuning current I is reduced and as a consequence the charge into the tuning amplifier is also reduced.

An in-lock situation can be detected by reading FLOCK. When the tuner oscillator frequency is within the programmable tuning window (TUW), FLOCK is set to logic 1. If the frequency is also within the programmable a.f.c. hold range (AFCR), which always occurs if AFCR is wider than TUW, control bit AFCT can be set to logic 1. When set, digital tuning will be switched off, a.f.c. will be switched on and FLOCK will stay at logic 1 as long as the oscillator frequency is within AFCR. If the frequency of the tuning oscillator does not remain within AFCR, AFCT is cleared automatically and the system reverts to digital tuning. To be able to detect this situation, the occurrence of positive and negative transitions in the FLOCK signal can be read (FL/1N and FL/0N). AFCT can also be cleared by programming the AFCT bit to logic 0.

The a.f.c. has programmable polarity and transconductance; the latter can be doubled up to 3 times, depending on the tuning voltage level if correction-in-band is used.

The direction of tuning is programmable by using control bits TDIRD (tuning direction down) and TDIRU (tuning direction up). If a tuner enters a region in which oscillation stops, then, providing the prescaler remains stable, no FDIV signal is supplied to CITAC. In this situation the system will tune up, moving away from frequency lock-in. This situation is avoided by setting TDIRD which causes the system to tune down. In normal operation TDIRD must be cleared.

If a tuner stops oscillating and the prescaler becomes unstable by going into self-oscillation at a very high frequency, the system will react by tuning down, moving away from frequency lock-in. To overcome this, the system can be forced to tune up at the lowest sensitivity (TUS) value, by setting TDIRU.

Setting both TDIRD and TDIRU causes the digital tuning to be interrupted and a.f.c. to be switched on.

The minimum tuning voltage which can be generated during digital tuning is programmable by VTMI to prevent the tuner being driven into an unspecified low tuning voltage region.

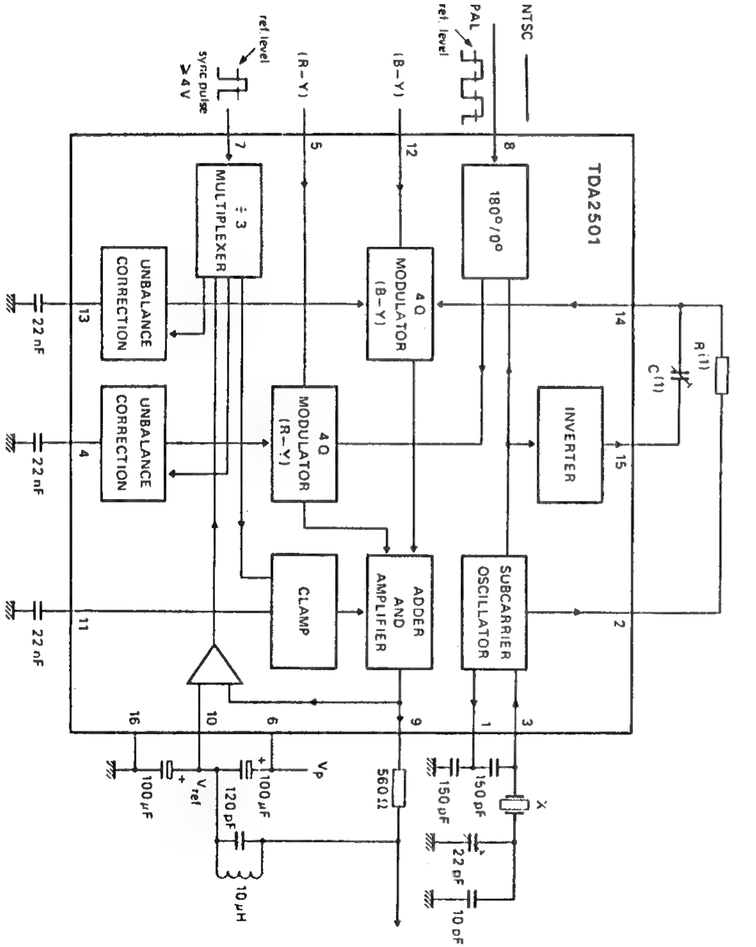


Fig. 1 Block diagram. Also test and application diagram.
(1) R = 0,885 (2 π fC); for PAL f = 4,433 619 MHz, R = 963 Ω and C = 33 pF.

PAL — NTSC ENCODER

The TDA2501 encodes two colour-difference signals R-Y and B-Y onto one subcarrier. Quadrature modulation allows the coding to be in accordance with either the PAL or NTSC system.

Functions:

- Generates two sinusoidal subcarriers with a relative phase of 90° (also accepts external subcarriers)
- Modulates the two subcarriers with the colour difference signals
- Inverts the output from one modulator on command of an external signal (as in case of PAL)
- Sums the output from the modulators to obtain a quadrature modulated output signal
- Clamps the output d.c. level to a reference voltage
- Divides the frequency of horizontal sync pulses by three so that the output level can be clamped and the balance of the two modulators sequentially controlled during the line-blanking minus burst-key period

QUICK REFERENCE DATA

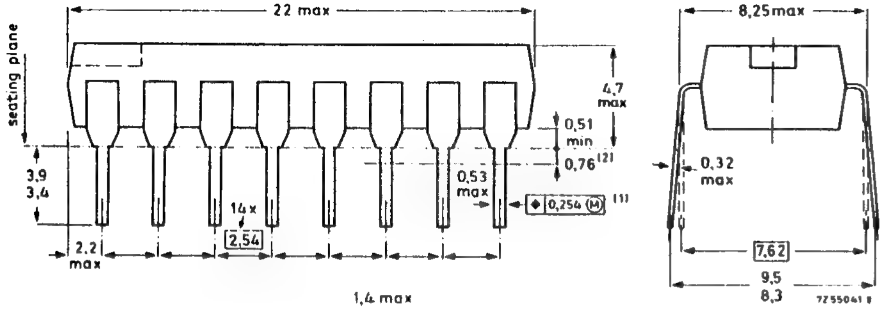
Supply voltage (pin 6)	V_P	typ.	6 V
Supply current	I_P	typ.	40 mA
Output chrominance voltage (pin 9)	$V_{9(p\text{-}p)}$	max.	1,4 V
Storage temperature	T_{stg}		−65 to +150 °C
Operating ambient temperature	T_{amb}		−25 to +70 °C

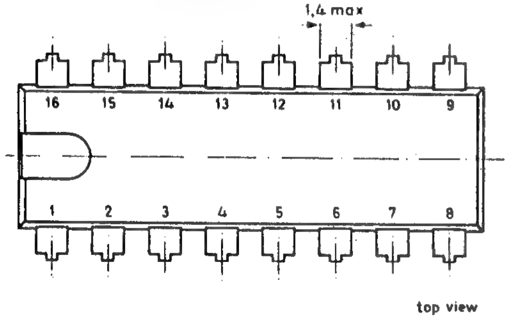
PACKAGE OUTLINE

16-lead DIL; plastic with internal heat spreader (SOT-38WE-2).

16-LEAD DUAL IN-LINE; PLASTIC WITH INTERNAL HEAT SPREADER

(SOT-38WE-2)





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

Dimensions in mm

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it). If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

DESCRIPTION

The colour difference signals B-Y and R-Y with a maximum amplitude of 1,4 volt are to be applied at pin 12 and pin 5. D.C.-coupling of the input signals is allowed if their d.c. levels are within specified limits from the d.c. level at pin 10 (V_{ref}). The following table shows these limits as a function of supply voltage. The table also shows the limits of the reference voltage range as a function of the supply voltage.

supply voltage $V_{6\text{-}16}$ (V)	input d.c. (R-Y) (B-Y) min. (V)*	$V_{5\text{-}16}$ $V_{12\text{-}16}$ (V) max. (V)*	reference voltage $V_{10\text{-}16}$ (V) min	typ.	max.
5,5	2,4	3,3	2,3	3,0	3,5
6,0	> V_{ref} – 1,4 V	3,8	2,4	3,3	3,9
7,0	> V_{ref} – 1,4 V	4,8	2,6	4,0	4,7
8,0	> V_{ref} – 1,4 V	5,8	2,8	4,8	5,5
9,0	> V_{ref} · 1,4 V	6,8	3,0	5,5	6,3
10,0	> V_{ref} – 1,4 V	7,8	3,2	6,3	7,1

* Minimum 2,4 V.
** At V_S – 2,2 V.
• Minimum values at 0,2 V_S + 1,2 V.
Typical values without pull-up or pull-down resistor.
Maximum values at 0,8 V_S – 0,9 V.

The inputs (B-Y) and (R-Y) should be zero, independent of their (limited) d.c.-levels, during the line-blanking minus burst-key period (LB – BK). Clamping the output and correcting the out-of-balance of the modulators, is done by applying a HIGH level to pin 7 within the (LB – BK) period (e.g. line sync pulse).

Modulation at output:
V_8 = LOW; output = sc x (B-Y) + sc′ x (R-Y)
V_8 = HIGH; output = sc x (B-Y) – sc′ x (R-Y)
in which sc′ = subcarrier
sc = 90° phase-shifted subcarrier to sc′ (sc lags).

The bandpass filter at the output suppresses the d.c. components of the (R-Y) + (B-Y) signal. Luminance (Y) is not processed by this circuit.

Internal subcarrier

The internal subcarrier oscillator is crystal controlled. The oscillator generates a sinewave with low harmonic distortion and an amplitude of about 500 mV peak-to-peak. The amplitude can be changed if necessary with a current input at pin 1. The adjustment range is 0 to 800 mV, with a corresponding current range of +250 to –150 μA.

Phase shift

To obtain a 90° phase-shifted carrier, two low impedance subcarrier outputs are provided, pins 2 and 15, the last being the inverse of the first. Between pins 2 and 15 an external RC combination must be used to obtain the desired 90° shift. The capacitor value must be limited to 33 pF to minimize subcarrier distortion.

The resistor required between pins 2 and 14 is 0,885 (2 π fC).

SECAM ENCODER

GENERAL DESCRIPTION

The TDA2506 converts colour-difference signals (D'_R and D'_B) into sequential, frequency modulated signals according to the SECAM system. The signals (D'_R) and (D'_B) are the colour difference signals before low-frequency pre-emphasis; D'_R = -1,9 (R-Y) and D'_B = +1,5(B-Y). The circuit is intended for use in video cameras, games, recorders and players, PAL-SECAM transcoding circuits and SECAM test signal generators.

Synchronizing pulses required for operation of the TDA2506 may be obtained from a universal sync generator SAA1043 or other pulse generator. All pulses are to be active HIGH and are as follows:

Horizontal sync pulses to pin 11
Half-rate horizontal sync (H/2) pulses to pin 9
Vertical sync pulses to pin 12
Chrominance blanking pulses to pin 13 (may include colour-killer pulses)

Frequency modulation is performed in conjunction with modulator-controller TDA2507.

Features

- Chrominance processor
- Vertical identification signal generator
- Timing pulse output to TDA2507
- Sample and hold circuit for control signal from TDA2507
- No adjustments of external components required (except high-frequency pre-emphasis (bell filter) stage)

QUICK REFERENCE DATA

Supply voltage	V_{4-2}	typ.	5	V
Supply current	I_4	typ.	45	mA
Reference voltage	V_{7-2}, V_{22-24}	typ.	3,5	V
Operating ambient temperature range	T_{amb}	–25 to +70		°C
Storage temperature range	T_{stg}	–65 to +150		°C

PACKAGE OUTLINES

24-lead DIL; plastic (with internal heat spreader) (SOT-101B).

Switched-gain summing amplifier and limiter

Inputs into the summing amplifier are the sequential $D'_R{}^*$ and $D'_B{}^*$ signals, the vertical identification sawtooth waveform and reference d.c. levels. The gain of the amplifier is switched by the internally delayed H/2 waveform to give the correct input amplitudes for the FM modulator ($D'_R{}^*$ gain = 280/230 x $D'_B{}^*$ gain). An offset is also introduced between the black levels of the $D'_R{}^*$ and $D'_B{}^*$ signals which corresponds to the upper and lower thresholds of the limiter.

FM modulator and phase switch

The FM modulator provides accurate FM modulation which follows the amplitude envelopes of the sequential $D'_R{}^*$ and $D'_B{}^*$ waveforms. The centre frequencies of 4 406,250 kHz for the $D'_R{}^*$ signal and 4 250,000 kHz for the $D'_B{}^*$ signal are controlled by d.c. levels from the sample and hold circuit (which in turn are controlled by the TDA2507). The upper and lower frequency limits are 4 756,000 ± 35 kHz and 3 900,000 ± 35 kHz.

Reference d.c. levels are switched within the FM modulator to define the starting phase of the modulator output (pin 23) at the initiation of each horizontal and vertical scan. The starting phase sequence is as follows:

vertical scan (frame to frame) 0°, 180°, 0°, 180°, repeating;
horizontal scan (line to line) 0°, 0°, 180°, 0°, 0°, 180°, repeating.

Chrominance blanking stage

The frequency modulated colour difference signals are passed via high-frequency pre-emphasis and band-pass filters to the chrominance blanking input at pin 3. The d.c. level of this input should be equal to the reference voltage at pin 7. Blanking occurs during the chrominance blanking pulse. The stage gain is 1,75.

Vertical identification sawtooth generator

Vertical sync, horizontal sync and chrominance blanking pulses are used to determine vertical identification (see Fig. 4). The vertical identification sawtooth generator is driven in opposite directions for identification signals IdR and IdB; the capacitor for the generator is connected at pin 14. If no vertical identification is required, pin 14 should be connected to the FM reference voltage at pin 22.

Pulse shaper

This stage developes all pulses that are required within the TDA2506 and also the timing pulses required for the modulator controller TDA2507 (see Fig. 3). Internal H/2 pulses are generated by a flip-flop working from the horizontal sync input (pin 11), this makes the H/2 input at pin 9 necessary only if it is required to lock the modulator into a specific phase sequence. If the H/2 input is not required, pin 9 should be connected to ground. A pulse separator at the chrominance blanking/colour-killer input (pin 13) allows this input to be used for blanking the sequential $D'_R{}^*/D'_B{}^*$ signal.

Sample and hold circuit

This circuit provides reference voltages to the FM modulator which set the centre modulation frequencies for the sequential $D'_R{}^*$ and $D'_B{}^*$ signals. The reference voltage levels are supplied to pin 15 from the TDA2507 in a sequence that is time-related to $D'_R{}^*/D'_B{}^*$ switching. The levels are sampled and then held for $D'_R{}^*$ using capacitors at pins 16 and 17, and for $D'_B{}^*$ using capacitors at pins 19 and 20.

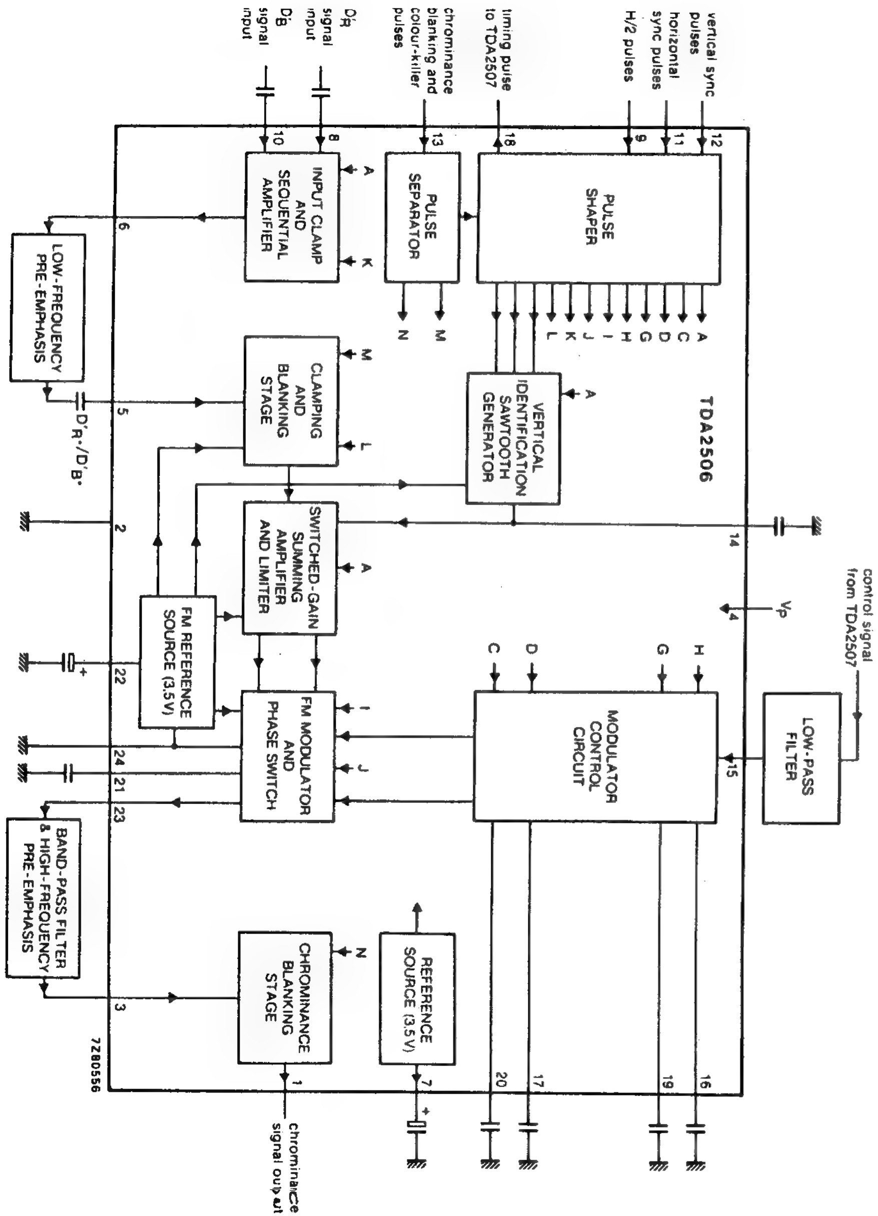


Fig. 1 Block diagram.

Pin functions

1. Chrominance signal output.
2. Ground.
3. Input to chrominance blanking stage from high-frequency pre-emphasis and band-pass filter.
4. Positive supply voltage.
5. Input to clamping and blanking stage from low-frequency pre-emphasis filter.
6. Output from sequential amplifier to low-frequency pre-emphasis filter.
7. Reference voltage output.
8. D'_R signal input.
9. H/2 pulse input (required only if specific phase sequencing is desired).
10. D'_B signal input.
11. Horizontal sync pulse input.
12. Vertical sync pulse input.
13. Chrominance blanking and colour-killer pulse input.
14. Capacitor for vertical identification sawtooth.
15. Control signal input from TDA2507 via low-pass filter.
16. 4 406,250 kHz frequency adjustment.
17. (R-Y) control.
18. Timing pulse output to TDA2507.
19. 4 250,000 kHz frequency adjustment.
20. (B-Y) control.
21. FM modulator tuning capacitor (fixed).
22. FM reference voltage output.
23. FM modulator output to high frequency pre-emphasis and band-pass filter.
24. Ground connection for FM modulator.

FUNCTIONAL DESCRIPTION

Input clamp and sequential amplifier

This circuit clamps the zero levels of the D'_R and D'_B input signals (pins 8 and 10) to the reference voltage from pin 7. The input signals are switched into the amplifier sequentially by an internally delayed H/2 waveform. The amplifier output at pin 6 is D'_R when the delayed H/2 waveform is HIGH and D'_B when it is LOW. The stage gain is 1,5.

Clamping and blanking stage

After external low-frequency pre-emphasis, the sequential $D'_R{}^*$ and $D'_B{}^*$ signals are returned to the IC at pin 5. The signal amplitude at pin 5 is typically 0,5 V (peak-to-peak value) for 75% colour bar (EBU). Black levels are clamped to the FM reference voltage (pin 22). Blanking takes place during the chrominance blanking pulse and, if required, during the video blanking and/or colour killing pulses.

FUNCTIONAL DESCRIPTION (continued)

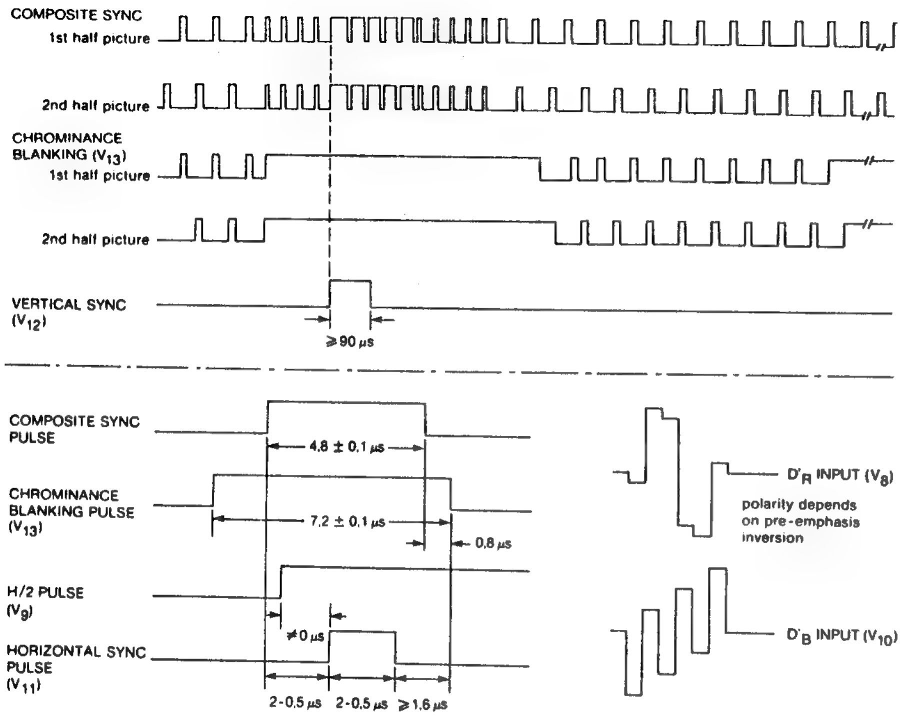


Fig. 2 Survey of input signals in relation to composite sync.

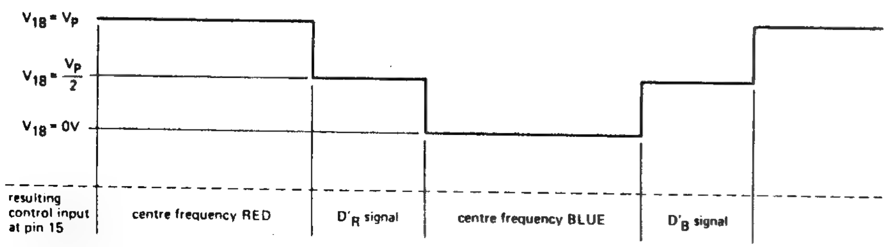


Fig. 3 Timing pulse output (pin 18) and resulting control input (pin 15).

FUNCTIONAL DESCRIPTION (continued)

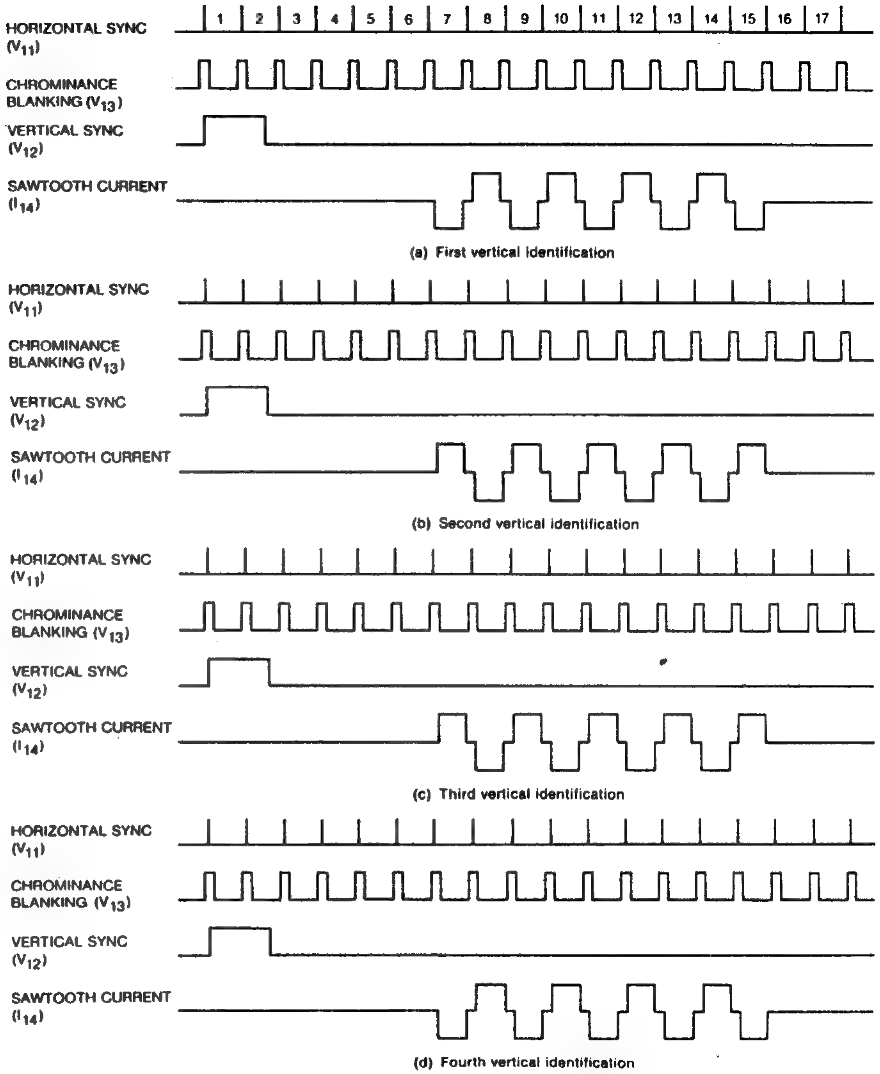


Fig. 4 Vertical identification generation.

FM MODULATOR CONTROLLER

GENERAL DESCRIPTION

The TDA2507 accepts FM signals that are sequentially modulated by two alternating subcarrier frequencies (SECAM signals) and provides sequential d.c. output levels to control the FM modulator.

The IC is intended for use with the SECAM encoder TDA2506 but can be adapted for other applications. Timing reference pulses from the modulator are required.

Two frequency reference phase-lock loops are contained within the IC; one for 4,406 25 MHz, and one for 4,250 MHz. Other frequencies can be accomplished by using external reference sources.

QUICK REFERENCE DATA

Supply voltage	$V_P = V_{3\text{-}6}$	typ.	5	V
Supply current at V_P = 5 V and with both PLL circuits functioning	I_3	typ.	40	mA
Reference voltage	$V_{2\text{-}6}$	typ.	3,5	V
Operating ambient temperature range	T_{amb}	−25 to	+70	°C
Storage temperature range	T_{stg}	−65 to	+150	°C

PACKAGE OUTLINES

16-lead DIL; plastic (with internal heat spreader) (SOT-38WE-9).

Pin functions

1. FM signal input (from TDA2506 pin 23).
2. Reference voltage output.
3. Positive supply voltage.
4. Horizontal sync output (f_H = 4 406,250/282 = 15,625 kHz).
5. Timing pulse input (from TDA2506 pin 18).
6. Ground.
7. Control signal output to TDA2506 via low-pass filter.
8. Input to synchronous demodulator from band-pass filter.
9. Output to band-pass filter.
10. Supply voltage for the divider stages and phase/frequency detectors of the two phase-lock loops.
11. Tuning capacitor for the 4,250 MHz reference oscillator.
12. Filter for the phase/frequency detector of the 4,250 MHz phase-lock loop.
13. Horizontal sync input (f_H).
14. Supply voltage for the two reference oscillators.
15. Tuning capacitor for the 4,406 25 MHz reference oscillator.
16. Filter for the phase/frequency detector of the 4,406 25 MHz phase-lock loop.

FUNCTIONAL DESCRIPTION

Phase-lock loops

The two phase-lock loops each comprise a voltage-controlled reference oscillator, two frequency divider stages and a phase/frequency detector circuit. The loops are closed by charge pumping the reference oscillators from the phase/frequency detector outputs. The centre frequencies of the loops are set by external capacitors at pin 15 (4,406 25 MHz) and pin 11 (4,250 MHz). The divider stages which follow the reference oscillators reduce the frequencies of both the loops to 15,625 kHz (f_H) at their respective inputs to the phase/frequency detectors. The reference signals to both phase/frequency detectors are obtained from the horizontal sync input at pin 13.

The divider and phase/frequency detector circuits can be switched off by connecting pin 10 to ground. This leaves only the VCO of each PLL in circuit and allows external signals to be injected at pins 15 and 11, or crystals to be used for tuning the oscillators.

The accuracy of crystal tuning using only one crystal can be obtained by connecting pins 10, 14 and 16 to the reference voltage at pin 2 and connecting a 4,406 25 MHz crystal to pin 15. The 4,250 MHz PLL will follow the crystal-derived f_H reference from pin 4 via pin 13 and its phase/frequency detector.

Multiplexer and pulse shaper

The multiplexer receives the 4,406 25 and 4,250 MHz reference frequencies from the two VCOs and the FM signals $D'_R{}^*$ and $D'_B{}^*$ from the TDA2506 modulator. The signals are gated one at a time to the multiplexer output in a sequence determined by the timing pulses from TDA2506. The levels of the timing pulses (pin 5) are used in the pulse shaper to generate enable pulses for the multiplexer (Fig. 2). The multiplexer output sequence is as follows:

4,406 25 MHz (2 lines); $D'_R{}^*$ FM signal (1 line); 4,250 MHz (2 lines); $D'_B{}^*$ FM signal (1 line); repeating. The selection of $D'_R{}^*$ or $D'_B{}^*$ FM signal is a feature of the timing of the input at pin 5.

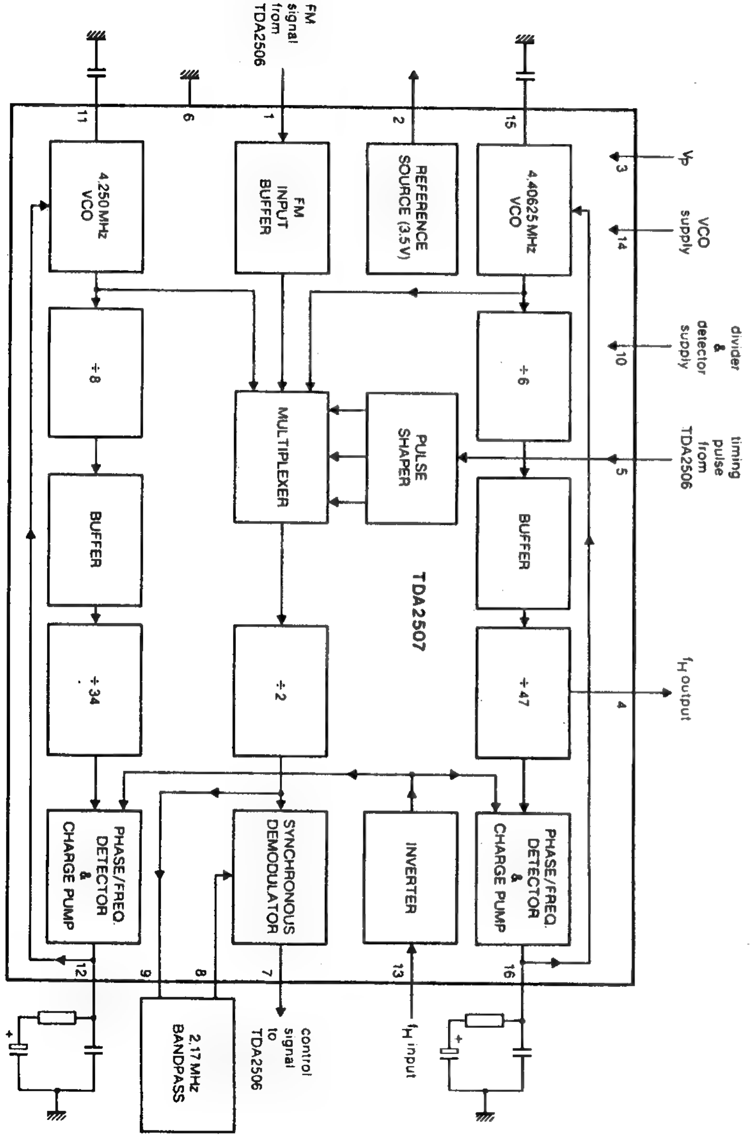


Fig. 1 Block diagram.

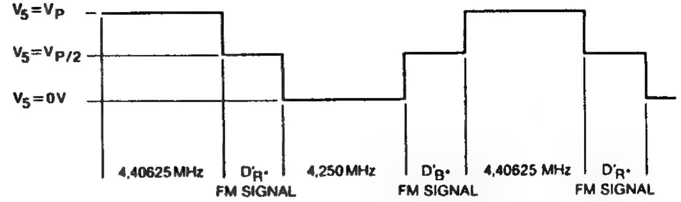


Fig. 2 Timing pulse waveform showing multiplexer output sequence.

Divide-by-two stage and synchronous demodulator

The divide-by-two stage halves the frequencies present in the multiplexer output and equalizes the amplitude and pulse shapes of the sequential signals.

Demodulation of the multiplexed signal is performed by filtering the signal via a 2,17 MHz band-pass filter (between pins 8 and 9) and using this filtered signal as a synchronous switch for the main signal. The d.c. level of the signal from pin 9 is referred externally to the reference voltage from pin 2. An external low-pass filter is required for the output signal from pin 7.

RATINGS

Limiting values in accordance with the Absolute Maximum Rating system IEC 134

Supply voltage	$V_{3\text{-}6}$	max.	13,2 V
Total power dissipation	P_{tot}	see Figs 3 and 4	
Operating ambient temperature range	T_{amb}		−25 to +70 °C
Storage temperature range	T_{stg}		−65 to +150 °C

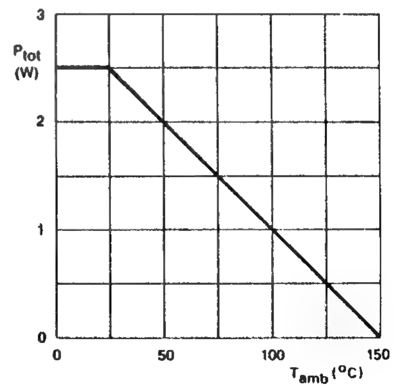


Fig. 3 Power derating curve for

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DTD Customer Support

Service Manual Supplement

94-07-15

SSU15122-1
4822 872 10132

TV SIGNAL GENERATORS PM 5415 / PM 5418

SUPPLEMENT TO: PM 5415/PM 5418 Service Manual 4822 872 15122

This supplement comprises additional and replacing information to the PM 5415/PM 5418 Service Manual, code 4822 872 15122.

New PM 5415/PM5418 TV Signal Generators with BTSC sound are available onwards July 1994 which are:
PM 5415 BC with/without Y/C
PM 5418 TD with/without Y/C
PM 5418 TDS with/without Y/C
PM 5418 TDSI with Y/C

Functions of the BTSC sound instruments are described in the PM 5415/PM 5418 Operating Manual, code 4822 872 10124 and PM 5415 BC Operating Manual 4822 872 10127.

This supplement contains (number of pages and sections are related to the Service Manual):

PAGE	CHAPTER SECTION	FIGURE	REMARKS	REPLACE	ADD
0-1/0-2 0-3/0-4 0-5/0-6			Contents	X X X	
3-1	3		Service procedure	X	
4-35 to 4-43	4.10.4 to 4.12		BTSC Sound Circuit Description, replace pages 4-35 to 4-39 by 4-35 to 4-43	X	
8-1 8-2 8-7/8 8-13/14 8-16/17	8.4		Recommended Test Equipment (Up date) Altered Deviation of Sound Carriers Table of Checks and Adjustment for: Mono Sound (altered values of deviation) RGB & Y/C Unit (correction, amendment) BTSC Sound	X X X X 	 X
		100B 101-1	Survey of Units and Versions for BTSC Overall Circuit Diagram including BTSC		X X
		157/ 158	TRIPLE-LF Unit, connections BTSC-LF Unit, component layout		 X
		159A/ 159B	BTSC-LF Unit, circuit diagrams		X

PAGE	CHAPTER SECTION	FIGURE	REMARKS	REPLACE	ADD
10-67/68 10-69/70	10		Spare parts, BTSC Sound: Mechanical parts, Electrical Parts	X 	 X
		  102A-1 102B-1 106-1 	**New version of Motherboard (Unit 11),** onwards LO 599...: Component layout Soldering side Modification circuit diagram part 4 Parts on the Motherboard		 X X X X
1 to 3		 110A/ 114A 107A 112A	**Additional Modifications:** 1. Motherboard, Components before LO599... 2. Digital Units (Unit 1 and Unit 1/VPS), onwards LO 599... 3. Sound Units, onwards LO609... 4. Multiburst Unit 6, onwards LO609... 5. Altered Parts, not on Units, onw. LO609..., refer to Section 10.10 and Fig. 10-2		 X X X X X

CONTENTS

FIGURES

continuous next page

3 SERVICE PROCEDURE

The PM 5415 / PM 5418 Color TV Pattern Generators are repaired on **single component level** or by **complete unit exchange.** For this all related circuit diagrams, component layouts and parts lists are published in this Service Manual. Some units have a multilayer PCB with mounted SMD components for example the Digital Unit 1, NICAM Units, and Teletext-PDC Unit. Special hints are given in Section 10.7.1 SMD Handling and Replacement.
Figure 101 shows the Overall Circuit Diagram with the interconnections between the Motherboard and the RF Unit (U10), Keyboard/Display Unit (U12), and the IEEE-bus Unit (U13). Figure 103 shows interconnections to Units U1 to U8. For getting access to the parts, see Chapter 6, 'Dismantling the Instrument'.

For repair and tests a **Service Kit** is available comprising 2 extension test boards and extraction tools, service code no. 5322 310 10579, see Figure 59.

Complete units can be ordered by service code numbers.
For instruments with NICAM sound and BTSC sound, only complete adjusted sets are available, consisting of two units:

1. NICAM sound set for PM 5415 TN. and PM 5418 TN.,
   consists of TWIN LF Unit (U7/TWIN) and TWIN RF Unit (U8/TWIN).

2. NICAM/BTSC sound for PM 5418 TD.,
   consists of TRIPLE-LF Unit (U7/TRIPLE) and TWIN-RF Unit (U8/TWIN).

3. BTSC sound for PM 5415 BC,
   consists of BTSC-LF Unit (U7/BTSC) and RF Stereo Unit (U8/ST).

A recalibration interval of 1 year is recommended for the TV Signal Generators PM 5415, PM 5418, and PM 5415BC.

If you need any assistance with relation to service on this instrument, you may well contact your local Fluke/Philips organization.

Sound Carrier 2, Figure 148

The sound carrier 2 frequencies 5.742 MHz, 5.850 MHz, and 6.552 MHz are generated by a PLL circuitry comprising of a Voltage Controlled Oscillator VCO2, lowpass filter N101, and PLL synthesizer D202.
Frequency setting is controlled from the CPU via C-bus lines DAT2, clock (SCL) and strobe (STR), shift register D201, and PLL circuit D202. 11.34 MHz (fREF) serves for reference of sound carrier 2 applied to input (OSCin) of the PLL circuit. D202 compares the carrier 2 frequencies (fSC2) generated by VCO2 with 11.34 MHz and supplies a tuning voltage at its phase detector output (PDout). In D202 the required division factors for the internal frequency comparison are reprogrammed according to the sound carrier frequency related to the selected TV system. The tuning voltage is smoothed by lowpass filter N101 and applied to varicap V208 of the VCO. For PAL I the carrier and amplitude are controlled via line D and for PAL B/G/H via line E by the bus expander D303, see Figure 146. Sound carrier 2 amplitude is adjustable by trimpot R221.
For DUAL and analog STEREO the sound signal (LF CH2) is passed via MUX D203 pin 5/4 to differential input of OP N101; the modulation voltage is superimposed on the tuning voltage applied to varicap V208 of the VCO2 (frequency modulation).
The deviation is adjusted by trimpot R201 to minimum crosstalk of left to right channel in STEREO mode.
In the FM modulation modes of sound carrier 2 (TV system B/G) the I- and Q-DATA lines of the 4-QPSK modulator are set to 6 V. The modulated carrier signal from VCO2 is applied via transistors V211/212 or V210/214, modulator N202/203 to the output SC2; the FM carrier is transferred by N202/N203 with constant amplitude and phase.

In NICAM mode the sound carrier is modulated digitally. For transmission the serial NICAM data are converted into two-bit parallel form. Each input-bit pair then determines the phase of the carrier. The carrier phase can assume one of four rest states separated by 90°. Each bit pair shifts the phase of the carrier by a designed amount, with the reference to the previous rest-state. This principle is called differentially encoded quadrature phase shift keying (4-QPSK).

Quadrature modulation is realized by two 4-quadrant multiplier circuits of type MC 1496 where the phase position of two orthogonal sound carrier signals are shifted by 0° or 180° and added. For this purpose the generated VCO2 signal is split into two paths. In the upper path the sound carrier is applied to a 90°-phase shifter V212 to get the quadrature component. In a parallel path (V210, V214) the inphase carrier signal is fed to multiplier N203.

For different TV systems NICAM B/G (5.85 MHz) or NICAM I (6.552 MHz) the 90°-phase shifter is switched over by control signal G. In NICAM I mode the signal G is set to logic high state, thus transistor V213 and diode V215 are switched off and capacitors C219/C221 are active. The phase can be adjusted by trimcap C221.
For TV system NICAM B/G the control signal G is low, transistor V213 and diode V215 are turned on, so capacitors C222 and C223 become active. The phase can be adjusted by trimcap C223.

For QPSK modulation the inphase- (0°) and quadrature signal (90°) of sound carrier 2 are applied to inputs CARR+ of the multiplier circuits, while I- and Q-data are fed to inputs SIG+. According to voltage difference of inputs SIG+ and SIG- a phase-shift keying of 0° and 180° of the carrier is realized. The modulated carrier products are summed at transformer T203 and are passed via buffer V217 to the RF Unit 10.
The amplitude of the I- and Q-signals must be equal and can be adjusted by trimpot R283 to the same value (see section 'Table of Checks and Adjustments).

4.10.4 BTSC SOUND

PM 5418 instruments with BTSC sound indicated by a 'D' in the type number have two sound units:
TRIPLE-LF Unit (U7/TRIPLE) and TWIN-RF Unit (U8/TWIN).
These units generate the following sound modes:
— analog AM/FM sound
— analog Dual/Stereo sound
— NICAM sound
— BTSC sound
The TRIPLE-LF Unit (U7/TRIPLE) consists of two PCBs, the BTSC-LF Unit (U7/BTSC) and the NICAM Unit (U7/NICAM), refer to Fig. 157.

PM 5415BC has two sound units:
the BTSC-LF Unit (U7/BTSC) and RF Stereo Unit (U8/ST).
These units generate the following sound modes:
— analog FM sound
— BTSC sound

Because of special BTSC test equipment, in case of replacement, complete adjusted sets, consisting of two units, can be ordered from PCS Eindhoven.

The BTSC Sound System

The BTSC (Broadcast Television System Committee) sound system is a Multichannel-Television Sound (MTS) standard that uses only one sound carrier to transmit a stereophonic as well as a second audio program. The BTSC standard was first introduced in the USA and later on in Canada and Taiwan. BTSC is transmitted in the TV system NTSC M. BTSC will also be introduced in Brazil for PAL M.

The four components of the BTSC composite signal are described below and shown in Figure 1.
— Main channel,
a monophonic L+R signal with a 75 μs pre-emphasis
— Pilot carrier,
locked to the line frequency fH (15.734 kHz)
— Stereo subchannel,
L-R signal, amplitude modulated on a suppressed subcarrier of 2xfH, compressed by the dynamic noise reduction system according to the BTSC specification.
— SAP (Second Audio Program) channel,
frequency modulated on a subcarrier of 5xfH (78.670 kHz), compressed by the dynamic noise reduction system according to the BTSC specification.

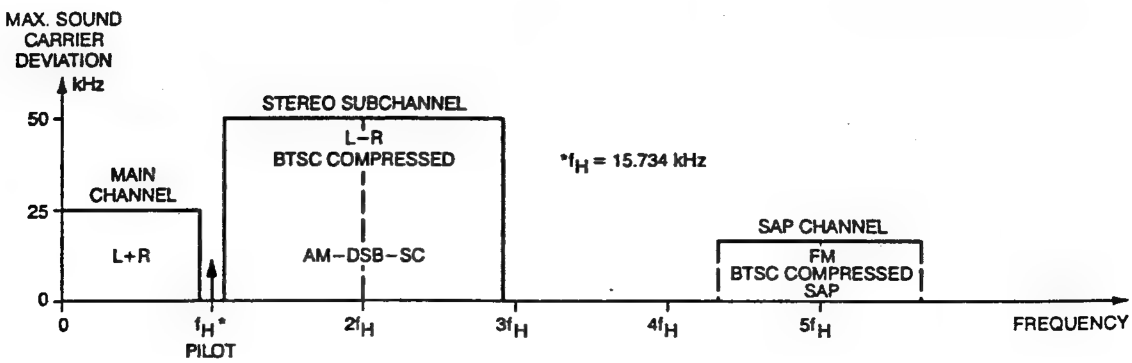


Fig. 1 BTSC Baseband Spectrum

The broadband baseband spectrum is transmitted via frequency modulation on the sound carrier (4.5 MHz). Due to the parabolic noise characteristic, which is typical for FM transmission systems, the noise level increases for higher frequencies. To improve the Signal-to-Noise Ratio of the L-R signal and the SAP signal, both channels are encoded by a BTSC Compressor.

The compressor on the transmitter side is reacting level and frequency dependent; so the expander on the receiver side has to respond exactly in the opposite way to guarantee proper signal processing mainly determined by stereo channel separation and frequency response. Therefore it is important to note that the audio signal levels are well defined, which is mostly done by giving the corresponding peak deviation of the sound carrier.

4.10.4.1 BTSC-LF UNIT (U7/BTSC), Figures 2, 157 to 159

The BTSC-LF Unit generates all audio frequencies for the different TV systems, pilot and identification signals for B/G Dual/Stereo, and the BTSC-baseband signal for NTSC and PAL M. Sampled values of this signals including the pre-defined relations in magnitude and phase are stored in PROMs and read out sequentially. After converting by DACs the analog signal passes active lowpass filters before AM/FM modulating of the sound carrier (Unit 8).

The Block Diagram (Fig. 2) mainly shows three signal paths comprising three sound data PROMs (D101, D109, D119), the corresponding Digital-to-Analog Converters (N104, N106, N107), and lowpass filters (N101, N102).
PROM 1 includes all data for the BTSC-baseband signal and BTSC test modes, furthermore data of the channel 1 signals (1 kHz, 3 kHz) for all other TV standards.
PROM 2 contains data for channel 2 signals and Scart-output (R) signals for BTSC, 1 kHz and 3 kHz.
PROM 3 contains data of the modulated pilot carrier including the identification frequencies for the PAL B/G Dual/Stereo sound standard. The generated frequencies are:
pilot carrier 54.6875 kHz, identification 117.5 Hz for Stereo, and 274.1 Hz for Dual.
Furthermore BTSC-sound data for the Scart-output (L), 1 kHz and 3 kHz are stored.
Three counters D114, D188 and D122 are used to address the PROMs. The address counters are clocked by the sampling frequency 20fH generated from the reference fH80 divided by 4 (D112). Thus all audio frequencies, DUAL/Stereo, and BTSC-baseband signals are related to fH.

The generated sound data are latched and converted by a 12 bit DA-Converter (N106) in the BTSC-signal path, while for the remaining signals paths (CH2 and identification signals) 8-bit DACs are used. The following analog lowpass filters suppress sampling frequencies and higher frequency components. The Butterworth filter N101 is of the 4th order with an upper frequency fu = 100 kHz while the other two filters N102 are of the 2nd order with an upper frequency of 55.4 kHz.

The sound signals are fed via the switches for internal/external sound and via the Pre-emphasis 50 µs/75 µs to the Stereo Matrix.
In the BTSC sound mode the Pre-emphasis is switched off because it is already included in the BTSC data PROM.
The final audio signals from Unit 7 are applied via connector X101 to the sound carrier 1 and sound carrier 2 paths of Unit 8.

All functions of the BTSC-LF Unit like Section Select, Address Count, switches, pre-emphasis, and matrix are controlled by the IIC-Bus Control D105 and D117 via control lines S0 to S19. Control lines S20 and S21 are not used.

For the available TV systems the following table shows the settings of the Stereo Matrix, Pre-emphasis, switches SW1 to SW5, and used parts of the PROMs.

Function Table BTSC-LF Unit

NO.	MODE	TV SYSTEM	MATRIX (S2*)	PRE-EMPHASIS 50 µs (S4*)	PRE-EMPHASIS 75 µs (S5*)	SWITCHES SW1 (S0*)	SW2 (S0*)	SW3 (S1*)	SW4 (S1*)	SW5 (S1*)	used Part in PROMs PROM 1 (S6...11*)	PROM 2 (S12...16*)	PROM 3 (S17...19*)
1	BTSC INTERN	M	off	off	off	a	a	b	b	b	BTSC	Scart2 (R)	Scart1 (L)
2	BTSC TEST	M	off	off	off	a	a	b	b	b	BTSC	—	—
3	STEREO INT.	B/G	on	on	off	a	a	a	a	a	CH1	CH2	Identif.Fr.
4	DUAL INTERN	B/G	off	on	off	a	a	a	a	a	CH1	CH2	Identif.Fr.
5	MONO INTERN	B/G/H,D,I,K,K1	off	on	off	a	a	a	x	a	CH1	CH2/Scart	—
6	MONO INTERN	M,N	off	off	on	a	a	a	x	a	CH1	CH2/Scart	—
7	MONO INTERN	L	off	off	off	a	a	a	x	a	CH1	CH2/Scart	—
8	MONO EXT.	M,N	on	off	on	b	b	a	x	a	—	—	—
9	STEREO EXT.	B/G	on	on	off	b	b	a	a	a	—	—	Identif.Fr.
10	DUAL EXT.	B/G	off	on	off	b	b	a	a	a	—	—	Identif.Fr.
11	MONO EXT.	B/G/H,D,I,K,K1	on	on	off	b	b	a	x	a	—	—	—
12	MONO EXT.	L	on	off	off	b	b	a	x	a	—	—	—
13	NICAM, INT. MONO/DUAL	B/G,I SECAM L	off off	on off	off off	a a	a a	a a	x x	a a	CH1 CH1	CH2 CH2	— —
14	NICAM, INT. STEREO	B/G,I	on	on	off	a	a	a	x	a	CH1	CH2	—
15	NICAM, TEST MODE	B/G,I	x	x	x	a	a	a	x	a	—	—	—
16	NICAM, RSSF LOW, INT.	B/G,I	off	on	off	a	a	a	x	a	CH1	CH2	—
17	NICAM, RSSF LOW, EXT.	B/G,I	on	on	off	b	b	a	x	a	—	—	—

* S0 ... S19 = Control Lines of Control Logic D105/D117

The BTSC sound characteristics can be checked and adjusted according to the Table of Checks and Adjustments, refer to pages 8-16/8-17. The BTSC-LF Unit itself needs no adjustment.

For details of the NICAM part of the TRIPLE-LF Unit (U7/TRIPLE), refer to Section 4.10.3 and Figures 140/141.

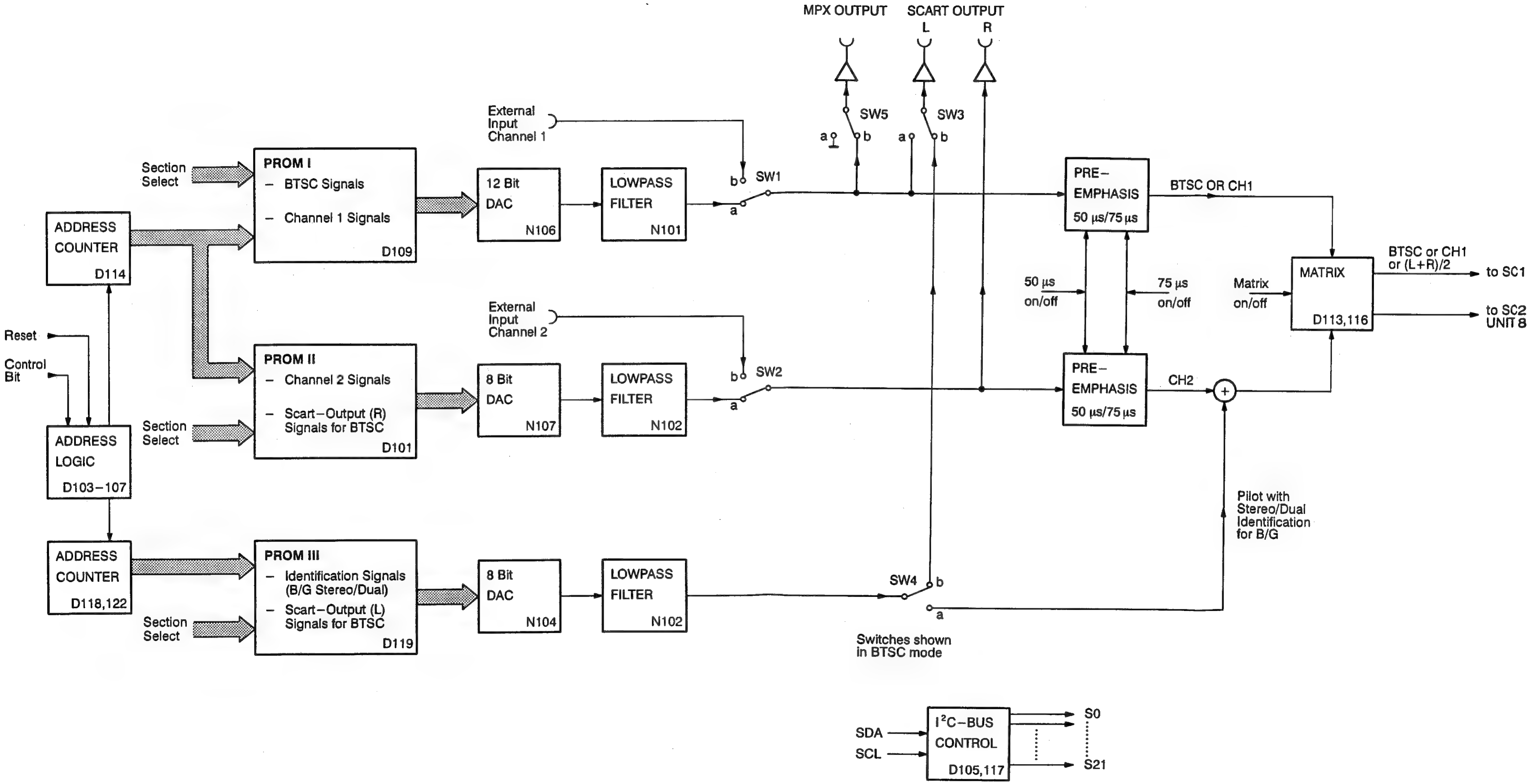
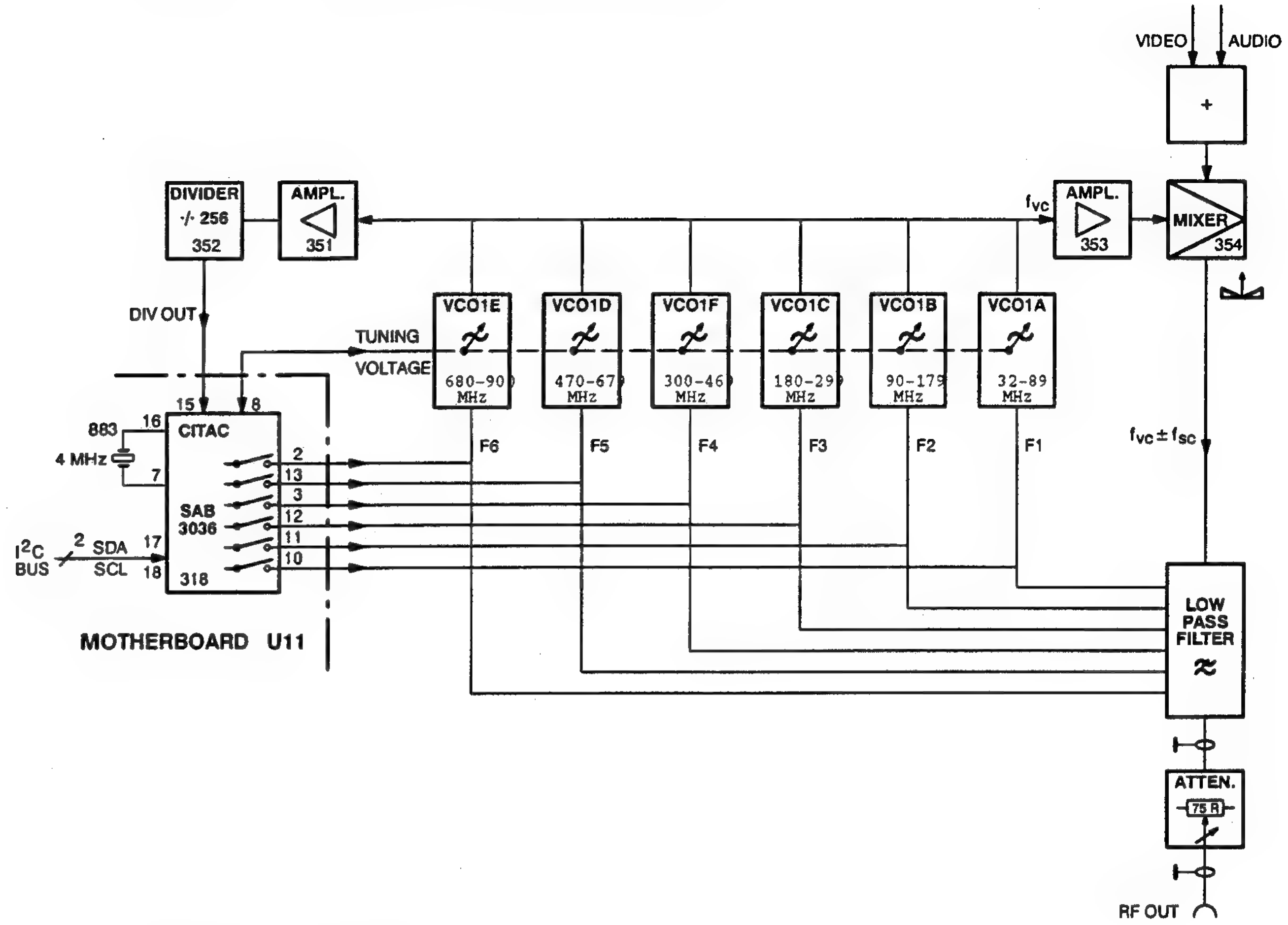


Fig. 2 Block Diagram BTSC LF Unit

4.11 RF UNIT (U10), Figures 149, 150



Block Diagram RF Unit

The RF Unit (U10) serves for generating a double-sideband modulated TV signal in the frequency range 32 MHz to 900 MHz. The unit consists of six oscillators, two amplifiers, modulator part, divider and lowpass filter which are built into different screened sections in the RF box. Supply voltages, control and modulation signals are applied from the motherboard U11.

Generation to the vision carrier frequency is achieved by six different oscillators VCO1A to VCO1F, five colpitts circuits up to 680 MHz and a Clapp oscillator for the upper frequency range 680 MHz to 900 MHz. These oscillators are turned on and tuned by the CITAC SAA3036 (Computer Interface for Tuning and Analog Control) via lines F1 to F6 and AFC from the motherboard. The CITAC is controlled by the microprocessor via the I²C-bus. The frequency ranges of the oscillators, tuning voltages and switching signals F1 to F6 are shown in the following table. The signals F1 to F6 are additionally used for switching the corresponding path of the lowpass filter.

Oscillator	Frequency Range (MHz)	Tuning voltage Range (Vdc)	Switching state CITAC output	IC318 (U11) Pin no.
VCO1A	32 to 89.75	≥3 to ≤27	H★	10
VCO1B	90 to 179.75	≥1.5 to ≤27	H	11
VCO1C	180 to 299.75	≥3 to ≤27	H	12
VCO1F	300 to 469.75	≥3 to ≤27	L	3
VCO1D	470 to 679.75	≥3 to ≤27	H	13
VCO1E	680 to 900.75	≥3 to ≤27	L	2

★ H = 12 V
L = 0 V

The oscillator voltage of VCO1B to VCO1F is coupled into a stripline by resistors 627 to 630 and R675 which are soldered to the inductance of the LC-circuit. By changing the position of the output coupling point the RF amplitude can be altered and serves for adjustment of the residual carrier, see section 'Table of Checks and Adjustments'; but adjustment should be done only if measured values exceed tolerances because of replaced components in the RF Unit, for example mixer or VCO1.

The RF signal is amplified by OM360 and fed into a 7 dBm double balanced mixer which is used as AM modulator. The video and sound signals are added at its modulating input 3/4. The video signal is dc-coupled (0.14 V to 1.54 V) while the sound signal is ac-coupled. From the output of mixer 354 the double-sideband modulated RF carrier is applied via the activated lowpass filter path and the RF attenuator (75 Ω) to the RF Output.

The lowpass filter operates in the lowest frequency range 32 MHz to 89.75 MHz as a tracking filter. The tuning voltage (AFC) is applied from the CITAC to varicaps 463 and 464 to tune the filter path. For frequencies >470 MHz the lowpass filter is by-passed via diodes 451 and 452. The filter needs no adjustment.

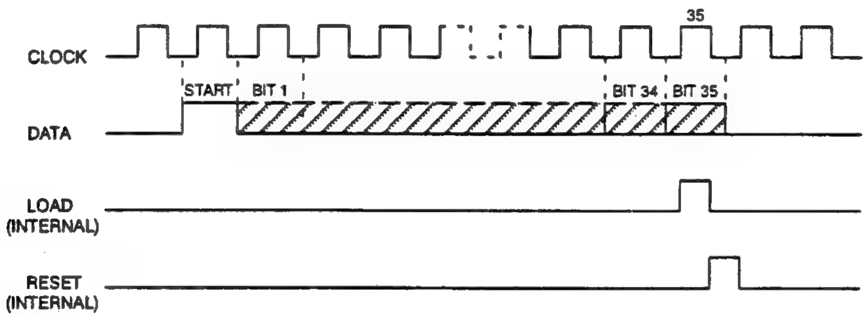
Additionally the generated RF carrier signal of VCO1A to VCO1F is used for the frequency control loop. The RF signal is applied from the stripline output to amplifier OM350, position 351. After dividing down by 256 the signal is fed via DIV OUTPUT to the CITAC (Unit 11). The CITAC compares this frequency with an internal generated reference (4 MHz clock) to supply the tuning voltage (AFC) for the VCO1 in order to lock the RF carrier frequency to the set value.

4.12 KEYBOARD AND DISPLAY UNIT (U12), Figures 151 to 153

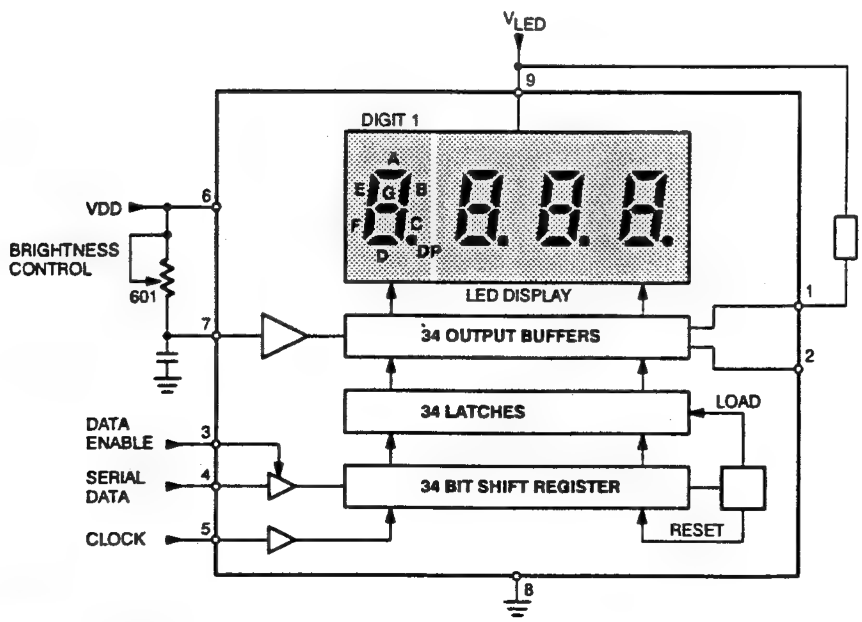
Depending on the instrument version two different Keyboard/display Units are mounted. Standard instruments have a keypad with 22 to 29 keys (Unit 12). Instruments with NICAM sound have an extended keyboard with a different PCB and 35 keys (Unit 12N).

Unit 12 contains a 4-digit LED display, pushbutton keys with the assigned LEDs next the keys (number of keys and LEDs depends on SOUND keypad) and its concerning decoder/driver circuits. Data transfer from the CPU is performed via the C-bus lines SCL, SDA and two control lines. Input data sensed from the keyboard matrix are sent as serial information from the control transmitter D301 via line KEYDAT to the CPU.

The display data including display and LED information are sent from the CPU via the C-bus to the display H451 and the LED display driver D302 by three signals: DATA (SDA), CLOCK (SCL), and Data Enable. Both display drivers have identical functions. The data format consists of a start bit followed by 34 data bits. During the data transfer from the CPU the enable lines $\overline{\text{DISEN}}$ and $\overline{\text{LEDEN}}$ are set and the data block is loaded to the shift register. These data are latched after the 35th bit is completed, thus providing non-multiplexed direct drive to the display/LEDs. A reset signal is generated internally which clears the shift register for the next data block.



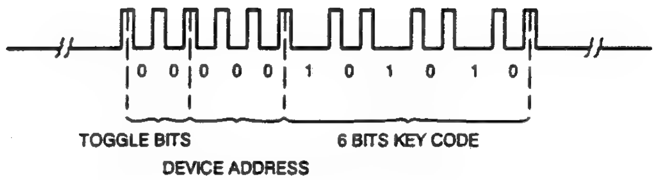
Input Data Format for Display and LEDs



Block Diagram Display H451

The brightness of the display is adjusted by potmeter R601 and for the LEDs by potmeter R602 in the Diagnostic Program, see 'Table of Checks and Adjustments'.

Input from the keyboard is achieved by means of the keyboard control transmitter D301, SAA3007, which controls the key matrix inputs and sends the keycode in serial data from the output pin 1 via line KEYDAT to the CPU. The input matrix consists of six driver outputs (D301 pin 13 to 18) and six sense inputs (pin 3 to 8). When a key is pressed the corresponding sense line is set to 'low' and D301 transmits a burst of 12 pulses including latched address and command codes. Data are available as long as a key is pressed.



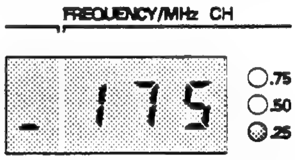
Data Format Signal 'KEYDAT'

For simple fault finding of the involved components of the keyboard and display please follow the 'Diagnostic Program', Section 7.2, sequence 2 to 5.

5 GENERAL FUNCTIONAL TEST

After POWER ON, the instrument is automatically set to the operating mode to which it was set before power off.

- Check for correct TV system:
  PM 5415, PAL/NTSC thumbwheel switch on the rear panel
  PM 5418, key PAL/NTSC/SECAM and the corresponding PAL/NTSC or SECAM thumbwheel switches on the rear panel.
- Under the SOUND area on the front panel, select the CARRIER and MODULATION INTERN by keys.
- Under the PATTERN area on the front panel, select the GREYSCALE/COLOR BAR/MULTIBURST patterns.
- Check the basic settings of the instrument:
  VIDEO AMPLITUDE 1 V
  CHROMA AMPLITUDE 100 %
- Set RF AMPLITUDE attenuator to 10 mV
- Select a vision carrier frequency that is suitable in the TV system, for example TV system G in VHF channel E5: 175.250 MHz (see table in the appendix).



- Connect the RF OUTPUT of PM 5415 / PM 5418 with the antenna input of a TV receiver.
- Check the correct video and sound reproduction on the TV receiver.
- Select and check additional test patterns.
- Connect an oscilloscope to the VIDEO OUTPUT (75 Ω termination).
- Select the patterns GREYSCALE/WHITE; set the VIDEO AMPLITUDE to stop position 1 V.
- Check that the video amplitude is 1 V (peak-peak), accuracy <5 %.

SUPPLEMENT TO: PM 5415/PM 5418 SERVICE MANUAL 4822 872 15122

ADDITIONAL MODIFICATIONS

1. Motherboard (U11)

The Service Manual shows on pages 10-14 to 10-16 some components of the Motherboard (U11) which are only mounted in instruments onwards serial number LO599...
The following components are mounted before LO599...

Pos.No.	Description				Ordering Code
C200	CAP.CERAMIC	100pF	2%	100V	4822 122 31316
C540	CAP.CERAMIC	47pF	2%	100V	4822 122 31072
C558	CAP.CERAMIC	27pF	2%	100V	4822 122 30045
C522	CAP.CERAMIC	100nF	10%	100V	5322 126 11584
R185	RES.METAL FILM	332R	1%	0.4W	4822 050 13321
R186	RES.METAL FILM	332R	1%	0.4W	4822 050 13321
R690	RES.METAL FILM	1K27	1%	0.4W	5322 117 10974

Motherboard (U11), Alterations onwards LO599...

C558	CAP.CHIP	27pF	5%	63V	4822 122 31825
C522	CAP.CHIP	100nF	10%	63V	4822 122 33496
R688	RES.METAL FILM	1K96	1%	0.4W	4822 050 11962

2. Modification on Digital Unit 16:9 and 16:9/VPS (Unit 1, Unit 1/VPS)

All PM 5415/PM 5418 instruments onwards serial number LO 599...,
Unit 1, Digital Unit 16:9 and Digital Unit 16:9/VPS:
Two additional capacitors C191 and C192 (330pF) are mounted on the soldering side of the PCB.
New delivered EPROM's, D209 of type N27C256, have a faster reaction time.
Only in case of replacement of the EPROM D209 the capacitors must be added. Otherwise the patterns may be faulty.
For details refer to Figures 107A, 110A/114A, and 112A.

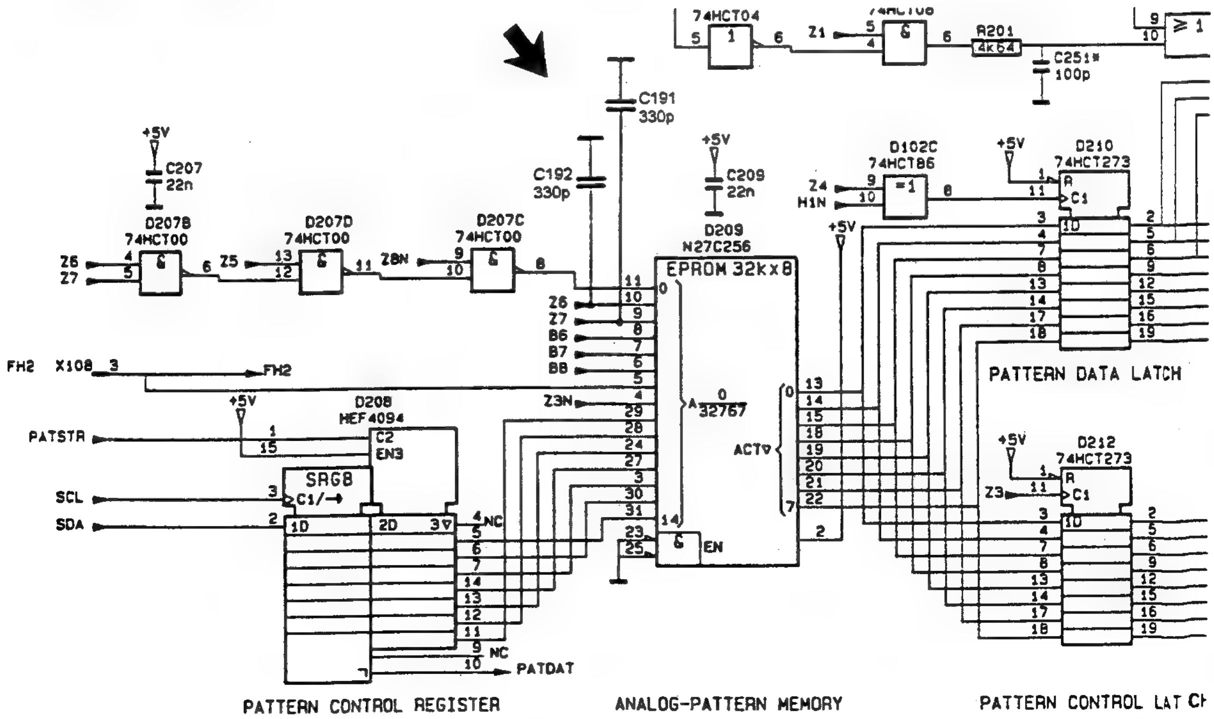


Fig. 110A/114A Part of Unit 1, Digital Unit 16:9 and Digital Unit 16:9/VPS

SUPPLEMENT TO: PM 5415/PM 5418 SERVICE MANUAL 4822 872 15122

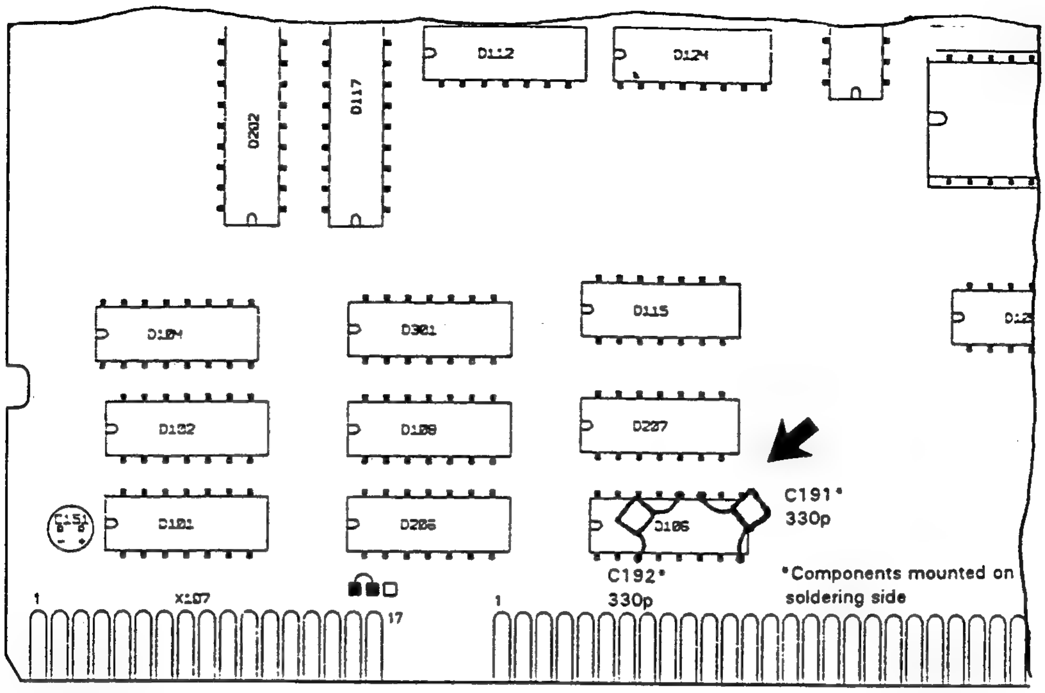


Fig. 107A Part of Unit 1, Digital Unit 16:9

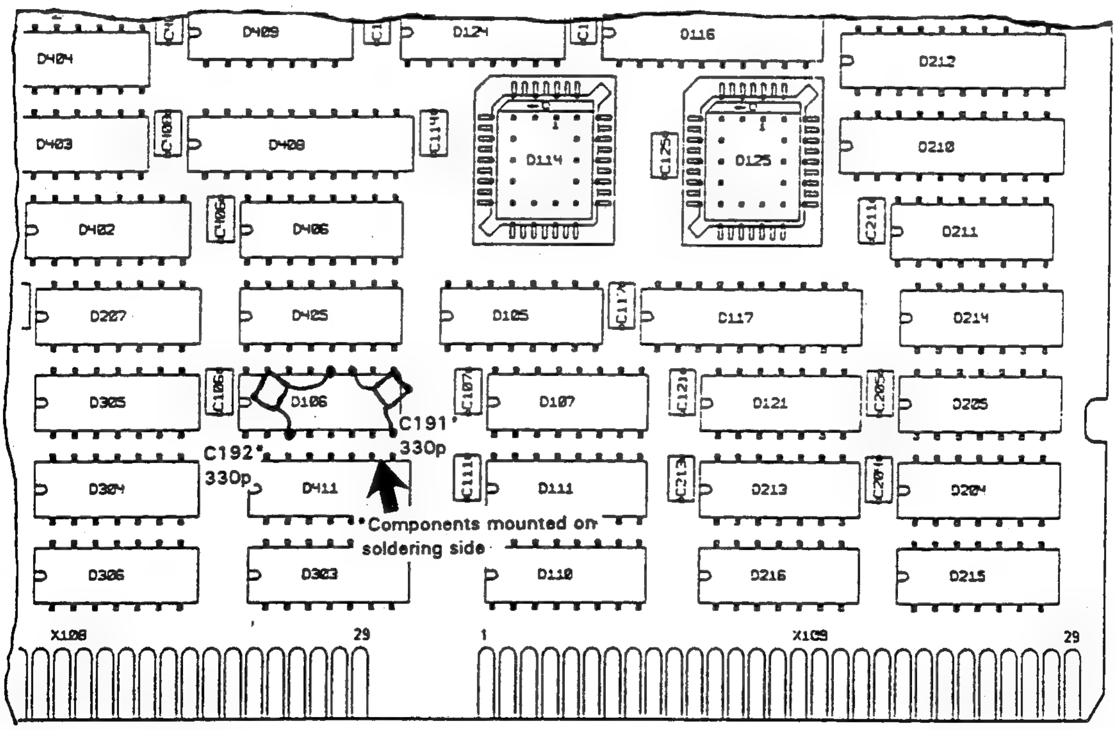


Fig. 112A Part of Unit 1, Digital Unit 16:9/VPS

Additional Parts on Digital Unit 1 (shown above):

Pos.No.	Description				Ordering Code
C191	Cap.Ceramic	330pF	10%	100V	4822 122 31165
C192	Cap.Ceramic	330pF	10%	100V	4822 122 31165

SUPPLEMENT TO: PM 5415/PM 5418 SERVICE MANUAL 4822 872 15122

3. Altered Parts on different Sound Units

The following parts are altered onwards serial number LO6Q9...
It is not necessary to modify elder instruments.

Pos.No.	Description				Ordering Code
RF Stereo Unit (U8/ST)					
C502	Cap.Ceramic	220nF	10%	100V	4822 121 41673
C521	Cap.Ceramic	220nF	10%	100V	4822 121 41673
R603	RES.METAL FILM	2K61	1%	0.4W	5322 117 10992
R605	RES.METAL FILM	2K61	1%	0.4W	5322 117 10992
R628	RES.METAL FILM	1K47	1%	0.4W	5322 117 10976
Mono Sound (U8)					
R630	RES.METAL FILM	2K61	1%	0.4W	5322 117 10992
R632	RES.METAL FILM	2K61	1%	0.4W	5322 117 10992
TWIN RF UNIT (U8/TWIN)					
C107	Cap.Ceramic	68pF	2%	63V	4822 126 12038
R115	RES.METAL FILM	162K	1%	0.25W	5322 117 10884
R117	RES.METAL FILM	38K3	1%	0.25W	5322 117 10902
R118	RES.METAL FILM	1K47	1%	0.25W	5322 116 83691
R122	RES.METAL FILM	6K81	1%	0.25W	5322 117 10921
R203	RES.METAL FILM	162K	1%	0.25W	5322 117 10884
R207	RES.METAL FILM	34K8	1%	0.25W	5322 117 10898

4. Altered Parts on Multiburst Unit 6

The following part is altered onwards serial number LO609...
It is not necessary to modify elder instruments.

Pos.No.	Description				Ordering Code
R785	RES.METAL FILM	68R1	1%	0.4W	4822 050 26819
R786	POTM.TRIMMER	4K7 CARB.LIN		0.1W	4822 100 10236

5. Altered Parts not on Units, refer to Section 10.10

The VIDEO and CHROMA potmeters are altered onwards serial number LO609...
The mechanical fixing is different.

Pos.No.	Description				Ordering Code
R601	POTM/SWITCH VIDEO	1K	LIN	20%	5322 101 40168
R602	POTM/SWITCH CHROMA	10K	LIN	20%	5322 101 40167

8 CHECKING AND ADJUSTING

8.1 GENERAL INFORMATION

This chapter provides the complete adjustment procedure for the instrument. Because various control functions are interdependent, a certain order of adjustment is necessary. The procedure is, therefore, presented in a sequence best suited to particular adjustment.

- Warm-up time under average conditions is 30 minutes
- Adjustment should be done after 1 hour
- Ambient temperature (23 ±1) °C
- Line voltage, nominal value ± 10 %
- The screening cover of the units must be closed and should be removed only for a short time for adjustment.
- Instrument performance should be checked before any adjustment is done
- All limits and tolerances given in this section are calibration guides, and should not be interpreted as instrument specifications
- Tolerances given are for instrument under test and do not include test equipment errors

WARNING

High voltages exist at several points inside the instrument. To avoid injury, do not touch exposed connections and components while power is on. Disconnect line power before removing protective panels, soldering, or replacing components.

8.2 RECOMMENDED TEST EQUIPMENT

The following abbreviations are used for settings and for the test equipments:

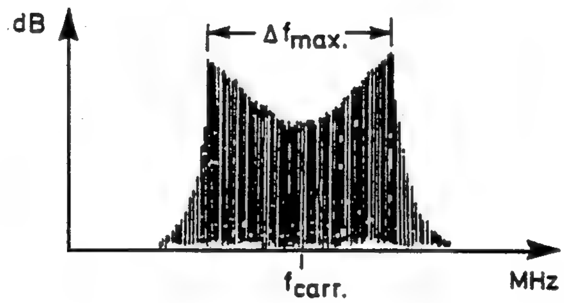
$\bar{\downarrow}$	≙	Keep setting concerned
–	≙	Parameter not used
•—	≙	Output, terminated with 75 Ω, e.g. Suhner >1 GHz 0.5 W
Vdc, Vac	≙	Digital multimeter for ac and dc measurement, e.g. Fluke 45
OSC	≙	Oscilloscope 50 MHz, e.g. PM 3055, line selector PM 8917 or PM 3382
C/T	≙	Counter/Timer, e.g. PM 6665
SPA	≙	Spectrum analyzer 1 GHz, e.g. TEK 2710/01
FAM	≙	Modulation analyzer, e.g. R&S FAM/B2/B8 or FMAB
TV	≙	TV receiver: Multi-system TV inclusive stereo, Teletext, RGB/YC-input
Vector	≙	Vectorscope PAL/NTSC, e.g. PM 5667, Vectorscope SECAM, e.g. TTV8300 (CS F)
Notch Filter	≙	3 MHz-notch filter; Adjustment Table, Sequence 3.2; Figure 58, Circuit Diagram
VPS/PDC	≙	Videorecorder with VPS/PDC (Video Programming System and Programme Delivery Control), e.g. Philips
NICAM	≙	NICAM Decoder PAL G or PAL I, e.g. PM 5688
BTSC	≙	BTSC Sound Demodulator inclusive FM Demodulator, TEK 751/01

For repair procedure a **Service Kit** is available comprising two extension test boards and extraction tools (see Figure 59).
The kit can be ordered from PCS Eindhoven with service code number 5322 310 10579.

8.3 SOUND MODULATION (FM)

8.3.1 Measurements with Spectrum Analyzer

The sound carriers and modulation can be checked directly at the RF OUTPUT. Accuracy of FM measurements with a spectrum analyzer depends on type (for example frequency span, IF bandwidth 1 to 3 kHz). Indicated values for Δf_{max} are dependent on the modulation frequency and selected pre-emphasis of the pattern generator. Δf_{max} is the frequency spacing of both spectral lines with maximum amplitudes above and below the carrier frequency.



TV system	Pre-emphasis	SOUND INT 1 kHz	Specification	Spectrum Analyzer Value Δf_{max}
PAL B,G,H	50 µs	x	30 ±2 kHz	60
SECAM B,G,H	50 µs	x	30 ±2 kHz	60
PAL M,N	75 µs	x	15 ±5 kHz	30
NTSC M	75 µs	x	15 ±5 kHz	30
Stereo	50 µs	x	30 ±2 kHz	60
Stereo L	50 µs	x	15 ±1 kHz	30

8.3.2 Measurements with Modulation Analyzer (FAM or FMAB)

Accurate deviation can be measured at the Sound Carrier Output (Unit 8, pin 5) of the Mono Sound Unit (U8), respectively the RF Stereo Unit (U8/ST) or TWIN RF UNIT (U8/TWIN).

Instrument settings FAM (FMAB):

De-emphasis: 50 µs for PAL/SECAM B,D,G,H,I,K,K1
75 µs for PAL M, N and NTSC M
Filter: 10 Hz to 20 kHz

The second sound carrier can be measured in the stereo sound instruments by selecting the **Diagnostic Program** (see Section 7.2):

DUAL press the DUAL key

Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	SOUND EXT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
	SETTINGS											MEASURING						
																		MONO SOUND UNIT (U8)
8.1	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT •–	SPA, TV	13 dB		R644, U8	x		Ratio vision to sound carrier, PAL G
8.2	PAL D	↓	↓	↓	↓	↓	↓			↓	↓	↓	11 dB ±1 dB				x	PAL D, K, K1, L
8.3	PAL I	↓	↓	↓	↓	↓	↓	–	–	↓	↓	↓	12 dB ±1 dB				x	PAL I
8.4	NTSC M												13 dB ±1 dB				x	NTSC, PAL M, PAL N
8.5	PAL G	PURITY RED	ON	MONO	OFF	OFF	470	1 V	100 %	max.	RF OUTPUT •–	SPA, TV	≤ −55 dBc				x	Intermodulation products
8.6	PAL G	↓	↓	↓	↓	↓	680/800	1 V	100 %	↓	↓	↓	≤ −50 dBc				x	(vision carrier to fvc ±1.1 MHz
8.7	PAL G						900	1 V	100 %				≤ −46 dBc				x	on screen no visible interference!
8.8	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	–	–	–	–	Unit 8, pin 5 (S130, pin 5)	C/T	5.5 MHz ±55 Hz				x	Sound carrier frequencies, PAL G Sound carrier is locked to master clock.
8.9	PAL D	↓	↓	↓	↓	↓					↓	↓	6.5 MHz ±65 Hz				x	PAL D
8.10	PAL I	↓	↓	↓	↓	↓	–	–	–	–	↓	↓	6.0 MHz ±60 Hz				x	PAL I
8.11	NTSC M												4.5 MHz ±45 Hz				x	NTSC M, PAL M, PAL N
8.12	PAL G	VIDEO EXT.	ON	MONO	ON 1 kHz	OFF	182.25	1 V	100 %	max.	RF OUTPUT •– (Unit 8, pin 5)	SPA, TV (FAM)	30 kHz ±0.5 kHz		R629, U8	x		Sound modulation FM, deviation, for measurement hints see Section 8.3
8.13	PAL D	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	26 kHz ±6 kHz				x	PAL D, K, K1
8.14	PAL I	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	28 kHz ±6 kHz				x	PAL I
8.15	NTSC M	↓	↓	↓	↓	↓	↓	↓	↓	↓			15 kHz ±5 kHz				x	NTSC M, PAL M, PAL N,
8.16	PAL G	↓	↓	↓	↓	↓	↓	↓	↓	↓	Scart C., pin 3	C/T Vac	1 kHz ±100 Hz 400 ±20 mV-rms				x	Internal audio signal, 1 kHz Amplitude int. audio signal
8.17	PAL G	VIDEO EXT.	ON	MONO	OFF	ON	182.25	1 V	100 %	max.	RF OUTPUT •– (Unit 8, pin 5)	SPA, TV (FAM)	30 kHz ±2 kHz				x	External sound modulation, FM deviation; apply ext. audio signal to AUDIO IN, pin 3: sine wave, 500 Hz, 400 ±20 mV-rms
																		ANALOG STEREO SOUND UNITS (U7/ST, U8/ST), for a rough check or function test use TV with Stereo/Dual sound decoder.
9.1	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT •–	SPA	13 dB		R614, U8/ST	x		Ratio vision to sound carrier 1
9.2	PAL D...M	VIDEO EXT.	ON	MONO	OFF	OFF	182.25	–	–	max.	RF OUTPUT •–	SPA	see Seq. 8.2/8.4				x	PAL D to PAL M, NTSC; use Seq. 8.2 to 8.4
9.3	PAL G	VIDEO EXT.	ON	STEREO	OFF	OFF	182.25	–	–	max.	RF OUTPUT •–	SPA	20 dB		R638, U8/ST	x		Ratio vision to sound carrier 2
9.4	PAL D...M	↓	↓	STEREO	↓	↓	↓			↓	RF OUTPUT •–	SPA	–				x	Sound carrier 2, not present
9.5	PAL G	↓	↓	MONO	↓	↓	↓	–	–	↓	Unit 8/ST, pin 5 (S130, pin 5)	C/T	5.5 MHz ±55 Hz				x	Frequency sound carrier 1 (standard instr.), sound carrier OSC is locked to the master clock
9.6	PAL D...M	↓	↓	↓	↓	↓	↓			↓	↓	C/T	see Seq. 8.9/8.11				x	PAL D to PAL M, NTSC; use Seq. 8.9 to 8.11
9.7	PAL G											C/T	5.5 MHz ±11 Hz				x	Frequency sound carrier 1 (IEEE-bus instr.)
9.8	PAL G	VIDEO EXT.	ON	DUAL*	OFF	OFF	182.25	–	–		Unit 8/ST, pin 5 (S130, pin 5)	C/T	5.742188 MHz ±57 Hz				x	Frequency sound carrier 2 (standard instr.), * select Diagnostic Progr., close solder joint 'TEST' (on Unit 11).
9.9	PAL G	↓	↓	↓	↓	↓	↓				↓	C/T	5.742188MHz ±12Hz				x	Frequency sound carrier 2 (IEEE-bus instr.)
9.10	PAL G	VIDEO EXT.	ON	MONO	1 kHz L	↓	↓				RF OUTPUT •– (Unit 8/ST, pin 5	SPA, TV FAM	±30 kHz ±0.5 kHz		R602, U8/ST	x		Sound modulation carrier 1 (FM), for hints see Section 8.3.
9.11	PAL D...M	↓	↓	↓	↓	↓	↓						see Seq 8.13/8.15				x	PAL D to PAL M, NTSC; use Seq. 8.13 to 8.15

Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	SOUND EXT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
	SETTINGS											MEASURING						
9.12	PAL G	VIDEO EXT.	ON	DUAL	1 kHz L/R	OFF	182.25			max.	RF OUTPUT •— (Unit 8/ST, pin 5)	SPA, TV (FAM)	±30 kHz ±0.5 kHz				x	FM, deviation DUAL sound, carrier 1 and 2
9.13				STEREO	1 kHz R								±30 kHz ±0.5 kHz *		R654, U8/ST	x		FM, deviation carrier 2 * final adjustment to minimum stereo cross-talk (L to R channel)
9.14				STEREO	1 kHz L								±15 kHz ±1 kHz				x	Deviation carrier 1, channel R = OFF
9.15				STEREO	OFF						RF OUTPUT •—		±2.5 kHz ±500 Hz				x	Deviation carrier 2 caused by pilot carrier
9.16	PAL G	VIDEO EXT	ON	MONO	1 kHz L	OFF	182.25			max.	Scart, pin 3	C/T, Vac	1 kHz ±100 Hz				x	Sound intern 1 kHz and 3 kHz,
9.17				MONO	3 kHz L	OFF					Scart, pin 3	C/T, Vac	3 kHz ±300 Hz				x	amplitude 400 mV ±20 mV-rms
9.18				STEREO	OFF	ON					RF OUTPUT •—	SPA (FAM), TV	±30 kHz ±2 kHz				x	Sound extern, FM deviation, apply ext. audio signal to AUDIO IN, pin 3: sine wave, 500 Hz, 400 ±20 mV-rms; apply to pin 5: sine wave, 2 kHz, 400 ±20 mV-rms
9.19	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF					Unit 7/ST, pin 20	Counter/Timer	54687.5 Hz ±0.5 Hz				x	Pilot frequency,
9.20				MONO							Unit 7/ST, pin 20	Vac	31 mV ±3 mV-rms				x	Amplitude of pilot signal
9.21				DUAL							U7/ST, IC315 pin 1	Counter/Timer	274.1 Hz				x	Indentification frequency, DUAL sound
9.22				DUAL							Unit 7/ST, pin 20	OSC	m = 50 % ±5 %				x	AM pilot carrier, DUAL sound
9.23				STEREO							Unit 7/ST, pin 20	OSC	m = 50 % ±5 %				x	AM pilot carrier, STEREO sound
9.24				STEREO							U7/ST, IC315 pin 7	Counter/Timer	117.5 Hz				x	identification frequency, STEREO sound
																		TWIN LF/TWIN RF SOUND UNITS (U7/TWIN, U8/TWIN), NICAM SOUND
10.1	PAL G	VIDEO EXT.	ON	MONO	OFF	OFF					Unit 8/TWIN, pin 5 (S130, pin 5)	Counter/Timer	5.5 MHz ±11 Hz				x	Sound carrier frequency (PAL G), the sound carrier OSC is locked to master clock
10.2	PAL D												6.5 MHz ±13 Hz				x	PAL D
10.3	PAL I												6.0 MHz ±12 Hz				x	PAL I
10.4	NTSC M												4.5 MHz ±9 Hz				x	NTSC M, PAL M, PAL N
																		Set instrument to the TEST mode: close solder joint 'TEST' on motherboard U11.
10.5	PAL G	VIDEO EXT.	OFF	NICAM	DATA 3						Unit 8/TWIN, pin 5 (S130, pin 5)	Counter/Timer	5.850 MHz ±12 Hz				x	NICAM carrier frequency, PAL G
10.6	PAL I		OFF	NICAM	DATA 3								6.552 MHz ±13 Hz				x	NICAM carrier frequency, PAL I
10.7	PAL G		ON	NICAM OFF	DUAL								5.7421875 MHz ±12 Hz				x	Sound carrier 2 frequency, analog STEREO leave the TEST, open solder joint 'TEST'
10.8	PAL G	VIDEO EXT.	ON	SOUND OFF NICAM OFF		OFF	182.25			max.	RF OUTPUT •—	SPA	13 dB	A*	R121, U8/TWIN	x		Ratio vision to sound carrier 1, PAL G
10.9	PAL I												12 dB ± 1 dB	A*			x	Ratio vision to sound carrier 1, PAL I
10.10	PAL D...M																	PAL D to PAL M, NTSC use Seq. 8.13 to 8.15
10.11	PAL G		ON	STEREO	OFF	OFF							7 dB	A*	R219, U8/TWIN	x		Ratio sound carrier 2 to sound carrier 1
10.12	PAL G, I		OFF	NICAM	DATA 3	OFF							7 dB ±2 dB	A*			x	Ratio NICAM carrier 1 to sound carrier 1
10.13	PAL G	WHITE GREY SCALE	OFF	OFF	OFF	OFF	182.25	1 V	100 %	max.	RF OUTPUT •—	SPA	−14 dB ±0.5 dB		R717, Unit 11	x		Residual carrier, set RF amplitude to <80 dBµV (10 mV at 75 Ω).
10.14	PAL G						650/900					SPA	−14 dB ±6 dB				x	Check equidistant steps of Greyscale in the linear demodulated video- or IF-signal.
10.15	SECAM L						182.25					SPA	−20 dB ±0.5 dB		R710, Unit 11	x		Residual carrier (AM pos.), only PM 5418 NICAM

A* = Figure A see next page

Seq.	TV SYSTEM	PATTERN	SOUND	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
	SETTINGS									MEASURING					
															RF UNIT 10 (only for experienced service workshops). The following table Seq. 14.1 to 14.21 should be used in case of faults and component replacements on U10. For access to parts remove upper screening cover.
14.1 14.2 14.3 14.4 14.5 14.6				32 to 89 90 to 179 180 to 299 470 to 679 680 to 900 300 to 469				Unit 10, pin 6 (AFC)	Vdc	3 V to ≤27 V 1.5 V to ≤27 V 3 V to ≤27 V 3 V to ≤27 V 3 V to ≤27 V 3 V to ≤27 V		L801 , U10 L802 , U10 L803*, U10 L804*, U10 L805*, U10 L810*, U10	x x x x x x		**Tuning voltage range,** (AFC): adjust core L801/802 * adjust by bending approp. coil L803 to L810 VCO 1a VCO 1b VCO 1c VCO 1d VCO 1e VCO 1f
14.7 14.8 14.9 14.10 14.11	PAL G	GREY SCALE	CARR. INT 1 kHz OFF	150 200 600 750 400	1 V	100 %	max.	RF OUTPUT •–	SPA**	20 dB■ ±3 dB 20 dB■ ±3 dB 20 dB■ ±6 dB 20 dB■ ±6 dB 20 dB■ ±6 dB ■ NICAM versions are adjusted to 14 dB		R627*, U10 R628*, U10 R629*, U10 R630*, U10 R675*, U10	x x x x x		**Residual carrier** (AM negative) * If necessary move position R627-630 or output coupling pt. (change soldering connection at the corresponding coil). No visual compression allowed of linear demodulated video signal. Adjustment influences intermodulation products fvc ±1.1 MHz, see Seq. 14.15 to 14.20. ** SPA setting: bandwidth approx. 1.5 MHz scanwidth zero (dispers./div).
14.12	SECAM L		CARR. INT 1 kHz ON	300 to 900			max. * or <10 mV	RF OUTPUT •–	SPA**	spurios signal ≤12 % of distance of neighbouring greyscale values		R629, R630, R675, U10	x		**SECAM L, 1 kHz spurious** modulated on video signal * depending on sensitivity of SPA do not overdrive the analyzer input ** SPA setting: bandwidth 1.5 MHz scanwidth zero scale linear
14.13	PAL G	VIDEO EXT	OFF	32 to 900			max.	RF OUTPUT •–	SPA	≥80 dBµV (10 mV)				x	**RF output level** (at 75 Ω)
14.14 14.15 14.16 14.17 14.18	PAL G	RED	CARR. INT 1 kHz OFF	90 to 179 180 to 299 300 to 469 470 to 679 680 to 900			max.	RF OUTPUT •–	SPA**, TV	≤ –55 dBc ≤ –55 dBc ≤ –55 dBc ≤ –50 dBc ≤ –50 dBc		R627*, U10 R628*, U10 R675*, U10 R629*, U10 R630*, U10	x x x x x		**Intermodulation products** (vision carrier to fvc ±1.1 MHz) * Move soldering connection at corresponding oscillator coil to high side; additionally check the residual carrier (see Seq. 14.7 to 14.11). ** SPA setting: bandwidth 120 kHz scanwidth 0.5 MHz
14.19 14.20 14.21		VIDEO EXT	OFF	32 to 299 300 to 469 470 to 900					SPA	±2 dBµV ±3 dBµV ±2 dBµV		R654, R655*, R656*, U10	x x x		**RF level flatness** * Adjustment serves for final matching influencing the residual carrier, video compression and intermodulation products, see Seq. 14.7 to 14.18.

	SETTINGS						MEASURING					
Seq.	TV SYSTEM	PATTERN	VIDEO AMPL	CHROMA AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
					REAR SIDE							**RGB & Y/C UNIT (U5)** If possible, use additional RGB-monitor
15.1	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT RED	OSC	Adjust amplitude to black/white level	31	R521, U5	x		Amplitude of multiburst pattern Amplitude response ≤ 10 mV
15.2							0.7 V ±150 mV	31			x	DC-offset (VDCO)
15.3a							0.7 V ±20 mV-pp	31			x	Signal amplitude
15.3b	NTSC						650 mV ±150 mV	37			x	DC-offset (VDCO), NTSC
15.3c							715 mV ± 20 mV (100 IRE ±2.8 IRE) *	37			x	Signal amplitude, NTSC * 1 IRE ≙ 7.14 mV
15.4	PAL/SECAM						see Fig.	31			x	Luminance PAL Y = 0.5; SECAM Y = 0.75
15.5							see Fig.	31,34			x	Check patterns (contents) Greyscale: equidistent steps; color bar
15.6					SYNC	OSC	−2.0 V ±0.2 V	43			x	Sync. pulse
15.7	PAL/NTSC				SUBCARRIER	OSC	1 V ±80 mV-pp				x	Amplitude subcarrier PAL/NTSC
15.8	PAL G, I				SUBCARRIER	COUNTER/TIMER	4.433619 MHz ±44 Hz*				x	Subcarrier frequencies,
15.9	PAL/NTSC				SUBCARRIER	COUNTER/TIMER	see. Seq. 4.3 to 4.5 *				x	for different systems see Seq. 4.3 to 4.5
							* fc ±7 Hz				x	* only instruments with NICAM or IEEE-bus
15.10	PAL/SECAM				OUTPUT RED	OSC	0.7 V ±20 mV-pp	44			x	Digital white
15.11	PAL I	COLOR BAR			OUTPUT RED	OSC	see Fig.	46			x	Color bar pattern, PAL I
15.12	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT GREEN	OSC	Amplitude at black/white level				x	Amplitude multiburst pattern Amplitude response ≤ 10 mV
15.13							0.7 V ±150 mV	32			x	DC level (VDCO)
15.14							0.7 V ±20 mV-pp	32			x	Signal amplitude
15.15							see Fig.	32			x	Luminance PAL Y = 0.5, SECAM Y = 0.75
15.16							see Fig.	32,35			x	Check patterns (contents) Greyscale: equidistent steps; color bar
15.17	PAL/SECAM						0.7 V ±20 mV-pp	44			x	Digital white
15.18	PAL I	COLOR BAR					see Fig.	47			x	Color bar pattern, PAL I
15.19	PAL/SECAM	GREY SCALE, COLOR BAR, MULTI BURST, DEM			OUTPUT BLUE	OSC	Amplitude at black/white level	33			x	Amplitude multiburst pattern Amplitude response ≤ 10 mV
15.20							0.7 V ±150 mV	33			x	DC-offset (VDCO)
15.21							0.7 V ±20 mV-pp	33			x	Signal amplitude
15.22							see Fig.	33			x	Luminance PAL Y = 0.5, SECAM Y = 0.75

Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
																	BTSC Sound PM 5418TD., concerns TRIPLE-LF UNIT (U7/TRIPLE) and TWIN RF UNIT (U8/TWIN)
16.1	NTSC M	VIDEO EXT.	ON	BTSC/ MONO	1 kHz					50 Ω MPX OUT	Vrms	192 ± 10 mV-rms				x	BTSC Sound Intern 1 kHz; Audio level
16.2											C/T	1 kHz ± 5 Hz				x	Internal audio frequency
16.3			ON	BTSC/ STEREO	CH1 = 3 kHz CH2 = 1 kHz	181.25 (CH 8)			max.	RF OUTPUT	TV (BTSC)					x x	Function test by TV incl. BTSC decoder, check sound fidelity L/R, check Stereo Identification
16.4				SAP ON	SAP MOD ON	181.25										x	SAP (Second Audio Program), 5 kHz Audio frequency
16.5	NTSC M	VIDEO EXT.	ON	BTSC/ STEREO	CH1 = 1 kHz CH2 = OFF SAP OFF					U8/TWIN Pin 5	TEK 751/01 + PM 8943A	≥40 dB *		R103 (U8/TWIN)	x		BTSC Stereo Channel Separation, used FM sound carrier 4.5 MHz, Equipment: connect active high ohmic FET probe 1:1 with 50 Ω output e.g. Philips PM 8943A to input 'Aural Carrier In' of the BTSC Decoder TEK 751/01. Connect input of the probe to Unit 8/TWIN Pin 5 (X101). Settings TEK 751: Processed Audio, RMS-Meter ON – set output selector to L – set RMS reference (Delta = 0 dB) – set output selector to R – read out **channel separation** * the processed output levels must not exceed L+R = 27 % to 28 %, L = 54 % to 55 %
																	Attention: Do not readjust the modulation deviation of the sound carrier 1 for other TV systems, refer to Seq. 10.16. For further checks/adjustments of the PM 5418 TD. sound units, refer to NICAM SOUND Seq. 10.1 to 10.15 and 10.17 to 10.28.

Seq.	TV SYSTEM	PATTERN	SOUND CARR	SOUND MODE	SOUND INT	FREQUENCY (MHz)	VIDEO AMPL	CHROMA AMPL	RF AMPL	Measuring Point/Unit	Measuring Instrument	Measured Value	Fig.	Adjustment Pos. No.	adjust	check	Explanation
	SETTINGS										MEASURING						
																	BTSC Sound PM 5415BC, concerns BTSC-LF UNIT (U7/BTSC) and RF STEREO UNIT (U8/ST)
16.6	NTSC M	VIDEO EXT.	ON	BTSC/ MONO	1 kHz					50 Ω MPX OUT	Vrms	192 ± 10 mV-rms				x	BTSC Sound Intern 1 kHz; Audio level
16.7											C/T	1 kHz ± 5 Hz				x	Internal audio frequency
16.8				BTSC/ STEREO	CH1 = 3 kHz CH2 = 1 kHz	181.25 (CH 8)			max.	RF OUTPUT	TV (BTSC)						Function test by TV incl. BTSC decoder,
																x	check sound fidelity L/R,
																x	check Stereo Identification
16.9				SAP ON	SAP MOD ON	181.25										x	SAP (Second Audio Program), 5 kHz Audio frequency
16.10	NTSC M	VIDEO EXT.	ON	BTSC/ STEREO	CH1 = 1 kHz CH2 = OFF SAP OFF					Unit 8/ST, Pin 5	TEK 751/01 + PM 8943A						BTSC Stereo Channel Separation, used FM sound carrier 4.5 MHz, Equipment: connect active high ohmic FET probe 1:1 with 50 Ω output e.g. Philips PM 8943A to input 'Aural Carrier In' of the BTSC Decoder TEK 751/01. Connect input of the probe to Unit 8/ST Pin 5 (X101). Settings TEK 751: Processed Audio, RMS-Meter ON – set output selector to L – set RMS reference (Delta = 0 dB) – set output selector to R
												≥ 40 dB *		R602 (U8/ST)	x		– read out **channel separation**
																	* the processed output levels must not exceed L+R = 27 % to 28 %, L = 54 % to 55 %
																	Attention: Do not readjust the modulation deviation of the sound carrier for other TV systems.
16.11	NTSC M	VIDEO EXT.	ON	FM MONO	1 kHz	181.25			max.	Unit 8/ST, Pin 5	FAM	15 kHz ± 5 kHz				x	FM sound modulation deviation, NTSC M
16.12	PAL G											30 kHz ± 6 kHz				x	PAL B/G/H
16.13	PAL I											31 kHz ± 6 kHz				x	PAL I
16.14	PAL D											27 kHz ± 6 kHz				x	PAL D
16.15	NTSC M				OFF				max.	RF OUTPUT	SPA	13 dB		R614 (U8/ST)	x		Ratio vision carrier to sound carrier
																	For further checks of the PM 5415 BC sound units, refer to MONO SOUND Seq. 8.1 to 8.17, except mentioned above.

Pos. No.	Description			Ordering Code

RESISTORS / U7 BTSC

R101-R104	RES.METAL FILM	750R	1% 0,25W	5322 116 81302
R105-R108	RES.METAL FILM	6K19	1% 0,25W	5322 117 11041
R109-R112	RES.METAL FILM	1K47	1%	5322 116 83691
R113,R116	RES.METAL FILM	1K96	1% 0,25W	5322 117 10887
R114	RES.METAL FILM	1K78	1% 0,25W	5322 117 10885
R117	RES.METAL FILM	51R1	1%	5322 116 83699
R118,R119	RES.METAL FILM	1K0	1% 0,25W	5322 116 81256
R121	RES.METAL FILM	31K6	1%	5322 116 83695
R122,R123	RES.METAL FILM	1K96	1% 0,25W	5322 117 10887
R124	RES.METAL FILM	31K6	1%	5322 116 83695
R126,R127	RES.METAL FILM	100K	1% 0,25W	5322 116 81258
R128	RES.METAL FILM	1K0	1% 0,25W	5322 116 81256
R129	RES.METAL FILM	5K11	1% 0,25W	5322 117 10913
R131	RES.METAL FILM	3K16	1% 0,25W	5322 117 10896
R132	RES.METAL FILM	11K	1% 0,25W	5322 117 10876
R133,R134	RES.METAL FILM	5K11	1% 0,25W	5322 117 10913
R136,R137	RES.METAL FILM	6K19	1% 0,25W	5322 117 11041
R138-R142	RES.METAL FILM	619R	1%	5322 116 83701
R143,R144	RES.METAL FILM	6K19	1% 0,25W	5322 117 11041
R146	RES.METAL FILM	1K78	1% 0,25W	5322 117 10885
R147	RES.METAL FILM	2K15	1%	5322 116 83693
R148	RES.METAL FILM	1K78	1% 0,25W	5322 117 10885
R149-R153	RES.METAL FILM	619R	1%	5322 116 83701
R154-R157	RES.METAL FILM	6K19	1% 0,25W	5322 117 11041
R158	RES.METAL FILM	1K78	1% 0,25W	5322 117 10885
R159	RES.METAL FILM	2K15	1%	5322 116 83693
R161	RES.METAL FILM	1K78	1% 0,25W	5322 117 10885
R162	RES.METAL FILM	6K81	1% 0,25W	5322 117 10921
R163,R164	RES.METAL FILM	100K	1% 0,25W	5322 116 81258
R165	RES.METAL FILM	31K6	1%	5322 116 83695
R166,R167	RES.METAL FILM	1K96	1% 0,25W	5322 117 10887
R168	RES.METAL FILM	31K6	1%	5322 116 83695
R169	RES.METAL FILM	11K	1% 0,25W	5322 117 10876
R171,R172	RES.NETWORK	22K	2% 0,2W	5322 117 11017
R176,R177	RES.METAL FILM	511K	1% 0,25W	5322 117 10915
R178,R179	RES.METAL FILM	2K37	1% 0,25W	5322 117 10889
R180-R182	RES.METAL FILM	1K0	1% 0,25W	5322 116 81256

MICELLANEOUS / U7 BTSC

X102	CONNECTOR 2X50-P (MUST BE SHORTENED)	5322 264 71048
X103	PIN FOR MINI COAX CONNECTOR	5322 268 14141
X104	MINI COAX CONNECTOR	5322 265 10266

Pos. No.	Description				Ordering Code

TRANSISTORS, DIODES / U7 BTSC

Pos. No.	Description		Ordering Code
V101	TRANSISTOR,CHIP	BC847B	4822 130 60511
V102	DIODE,REFERENCE	BZV55-B7V5	4822 130 82887
V103-V108	TRANSISTOR,CHIP	BC847B	4822 130 60511
V111-V114	DIODE,REFERENCE	BZV55-B3V0	4822 130 82886

CAPACITORS / U7 BTSC

Pos. No.	Description				Ordering Code
C100	CAP.CHIP	22NF	10%	63V	4822 122 31797
C101	CAP.CHIP	680PF	2%	63V	4822 122 31775
C102	CAP.CHIP	470PF	2%	63V	4822 122 31727
C103	CAP.CHIP	1,5NF	2%	63V	4822 126 12717
C104	CAP.CERAMIC	3300PF	2%	63V	5322 122 33897
C106	CAP.CHIP	220PF	2%	63V	4822 122 31965
C107	CAP.CERAMIC	1NF	1%	50V	5322 122 40894
C108	CAP.CERAMIC	1.5NF	1%	50V	5322 122 40891
C109	CAP.CHIP	22NF	10%	63V	4822 122 31797
C111-C116	CAP.CHIP	100NF	10%	63V	4822 122 33496
C117	CAP.CHIP	680PF	2%	63V	4822 122 31775
C118	CAP.CHIP	10NF		50V	4822 122 32442
C119-C121	CAP.CHIP	22NF	10%	63V	4822 122 31797
C122	CAP.CHIP	10NF		50V	4822 122 32442
C123-C127	CAP.CHIP	100NF	10%	63V	4822 122 33496
C128,C129	CAP.CERAMIC	1000PF	2%	63V	4822 122 31746
C131	CAP.CERAMIC	3300PF	2%	63V	5322 122 33897
C132	CAP.CHIP	680PF	2%	63V	4822 122 31775
C133	CAP.CERAMIC	2700PF	2%	63V	4822 126 10171
C134,C136	CAP.ELECTROLYT.	47UF	20%	16V	5322 124 80989
C137	CAP.CERAMIC	1NF	1%	50V	5322 122 40894
C138	CAP.CERAMIC	1.5NF	1%	50V	5322 122 40891
C139-C142	CAP.ELECTROLYT.	47UF	20%	16V	5322 124 80989
C143	CAP.CHIP	22NF	10%	63V	4822 122 31797
C144	CAP.CHIP	22NF	10%	63V	4822 122 31797
C145-C149	CAP.CHIP	22NF	10%	63V	4822 122 31797
C151-C152	CAP.CERAMIC	1000PF	2%	63V	4822 122 31746
C153	CAP.CERAMIC	3300PF	2%	63V	5322 122 33897
C154	CAP.CHIP	680PF	2%	63V	4822 122 31775
C156	CAP.CHIP	10NF		50V	4822 122 32442
C157-C162	CAP.CHIP	100NF	10%	63V	4822 122 33496
C163-C164	CAP.CHIP	22NF	10%	63V	4822 122 31797
C166-C168	CAP.CHIP	10NF		50V	4822 122 32442

Pos. No.	Description	Ordering Code

SPARE PARTS BTSC SOUND

MECHANICAL PARTS, CABLES

TEXTPLATE PM 5418TD	5322 455 71095
TEXTPLATE PM 5418TDS	5322 455 71096
TEXTPLATE PM 5418TDSI	5322 455 71097
TEXTPLATE PM 5415BC	5322 455 71094
CAP PUSHBUTTON BLACK	5322 414 70187
RF CABLE BNC TO F-CONNECTOR	5322 321 62652
EURO AV TO CHINCH	5322 321 62653
COAX CABLE TO MPX	5322 320 11112

UNITS COMPLETE (PREADJSTED SETS)

BTSC SOUND SET (PM 5415BC)	5322 214 91438
MULTI STANDARD NICAM/BTSC SOUND SET (PM 5418TD..)	5322 214 91437

LOADED PROMS

D313	PROM LOADED CPU PM 5415BC	5322 209 52645
D313	PROM LOADED CPU PM 5418BTSC	5322 209 52646
D101	PROM LOADED BTSC-DATA 2	5322 209 52648
D109	PROM LOADED BTSC-DATA 1	5322 209 52647
D119	PROM LOADED BTSC-DATA 3	5322 209 52649

BTSC-LF UNIT (U7/BTSC)

INTEGRATED CIRCUITS / U7 BTSC

D102	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
D103	INTEGR.CIRCUIT	PC74HC08T	5322 209 71564
D104	INTEGR.CIRCUIT	PC74HC11T	5322 209 33736
D105	INTEGR.CIRCUIT	SAA1064T	4822 209 32304
D106	INTEGR.CIRCUIT	PC74HC4075T	5322 209 33735
D107	INTEGR.CIRCUIT	PC74HC21T	5322 209 60437
D111	INTEGR.CIRCUIT	PC74HC174T	4822 209 12496
D112	INTEGR.CIRCUIT	PC74HC112T	4822 209 30544
D113	INTEGR.CIRCUIT	PC74HC4053T	4822 209 60792
D114	INTEGR.CIRCUIT	PC74HC4040T	4822 209 30847
D115,D116	INTEGR.CIRCUIT	PC74HC4053T	4822 209 60792
D117	INTEGR.CIRCUIT	PCF8574T	5322 209 11578
D118,D122	INTEGR.CIRCUIT	PC74HC4040T	4822 209 30847
D121,D123	INTEGR.CIRCUIT	PC74HC574T	4822 209 60451
N101,N102	INTEGR.CIRCUIT	LM837M	4822 209 30848
N103	INTEGR.CIRCUIT	TL074ACD	4822 209 30813
N104,N107	INTEGR.CIRCUIT	DAC-08ED	5322 209 73513
N106	INTEGR.CIRCUIT	DAC-312HS	5322 209 33734

Pos. No.	Description				Ordering Code

CRYSTALS / U13

G781	CRYSTAL	6,000 MHZ			4822 242 70392

MISCELLANEOUS / U13

A751	TRANSFORMER	5322 148 80845
X801	CONNECTOR SUD-D, 9-P MALE	5322 265 40755
X802	CONNECTOR IEEE	5322 267 60162
S803	ADDRESS SWITCH	5322 277 10967

MECHANICAL PARTS, HOUSING / U13

X317	IC SOCKET DIL 28-P	5322 255 44047
--	TEXT PLATE PM9547G	5322 455 71091
--	REAR PLATE PM9547G	5322 447 92209
--	HOUSING PM9547G	5322 447 92211
--	RUBBER FOOT	5322 532 11588
--	HEATSINK	5322 255 41317

IIC-BUS ADAPTER (U13A)

UNIT 13A COMPLETE	5322 214 91339

INTEGRATED CIRCUITS / U13A

D301	INTEGR.CIRCUIT	PC74HCT03P	5322 209 11316

TRANSISTOR, DIODES / U13A

V401-V404	DIODE	BAX12A	5322 130 34605

CAPACITORS / U13A

C501	CAP.CERAMIC	10NF		100V	4822 122 31414

RESISTORS / U13A

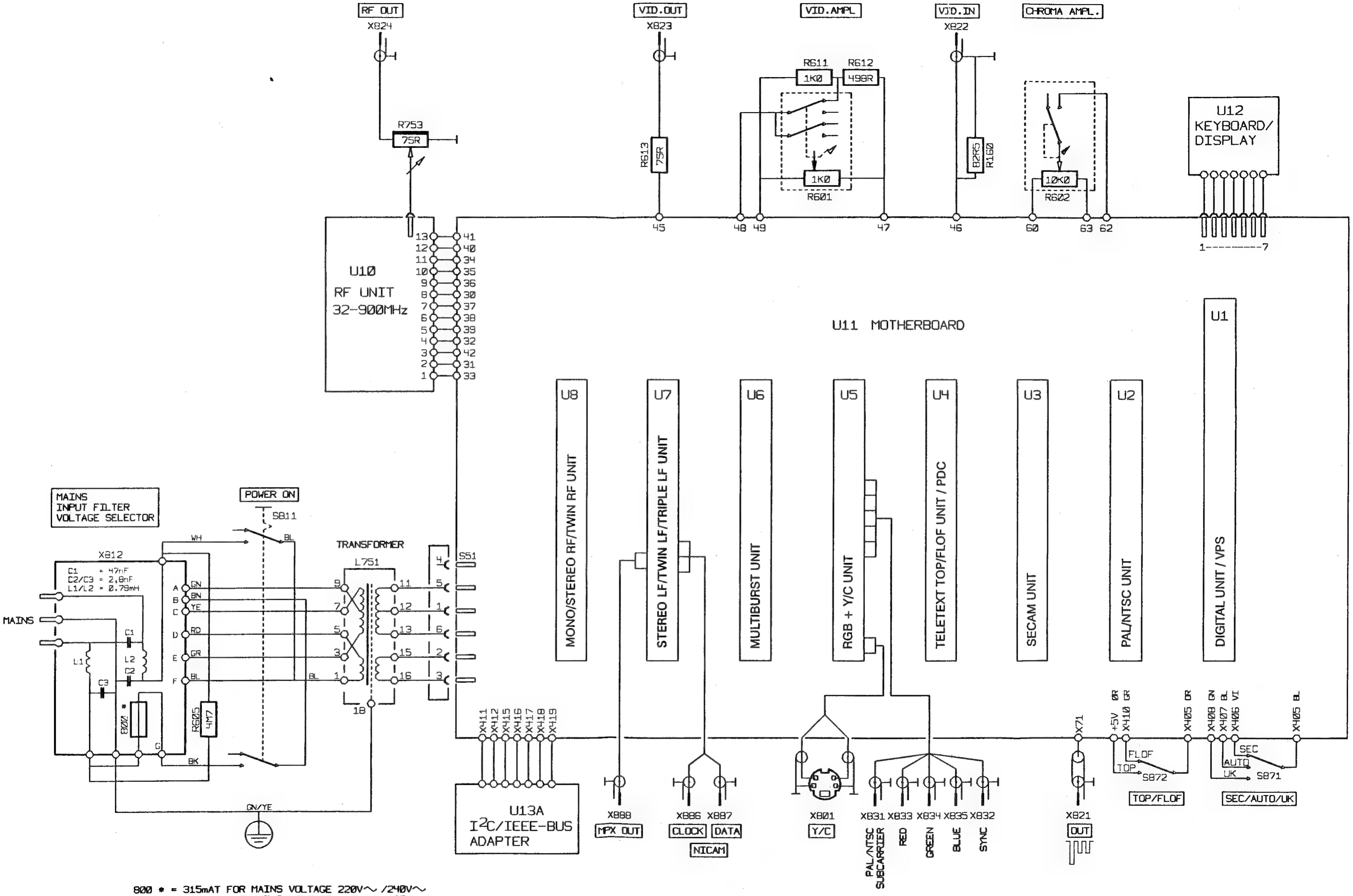
R601,R602	RES.METAL FILM	100R00	1%	0,4W	4822 050 11001
R603,R604	RES.METAL FILM	10K00	1%	0,4W	4822 050 11003

MISCELLANEOUS / U13A

X801	CONNECTOR, 9-P FEMALE	5322 267 50594

PM 5418 TDSI + Y/C	PM 5418 TDS + Y/C	PM 5418 TDS	PM 5418 TD + Y/C	PM 5418 TD	PM 5415 BC + Y/C	PM 5415 BC	Instrument Versions	Units
×	×	×	×	×	×	×	MOTHERBOARD	U11
			×	×	×	×	DIGITAL UNIT	U1
×	×	×					DIGITAL UNIT VPS	U1/VPS
	×	×	×	×	×	×	PAL/NTSC UNIT	U2
×							PAL/NTSC UNIT TXI/TNSI/TDSI	U2/IEEE
	×	×	×	×			SECAM UNIT	U3
×							SECAM UNIT TXI/TNSI/TDSI	U3/IEEE
			×	×			TELETEXT TOP/FLOF	U4
×	×	×			×	×	TELETEXT / PDC / CC	U4/PDC
×	×		×		×		RGB + Y/C UNIT	U5
	×	×	×	×	×	×	MULTIBURST	U6
×							MULTIBURST TXI/TNSI/TDSI	U6/IEEE
							LF STEREO UNIT	U7/ST
					×	×	BTSC–LF UNIT	U7/BTSC
					×	×	RF STEREO UNIT	U8/ST
							MONO SOUND UNIT	U8
×	×	×	×	×			TRIPLE–LF UNIT	U7/TRIPLE
×	×	×	×	×			TWIN RF UNIT	U8/TWIN
×	×	×	×	×	×	×	RF UNIT	U10
							KEYBOARD UNIT	U12
×	×	×	×	×	×	×	KEYBOARD UNIT NICAM	U12/N
×							IEEE–BUS UNIT	U13
×							I²C–BUS ADAPTER	U13 A

Fig. 100B Survey of Units and Versions Amendment



800 * = 315mAT FOR MAINS VOLTAGE 220V~ /240V~
630mAT FOR MAINS VOLTAGE 110V~ /120V~

Fig. 101-1 Overall Circuit Diagram with BTSC

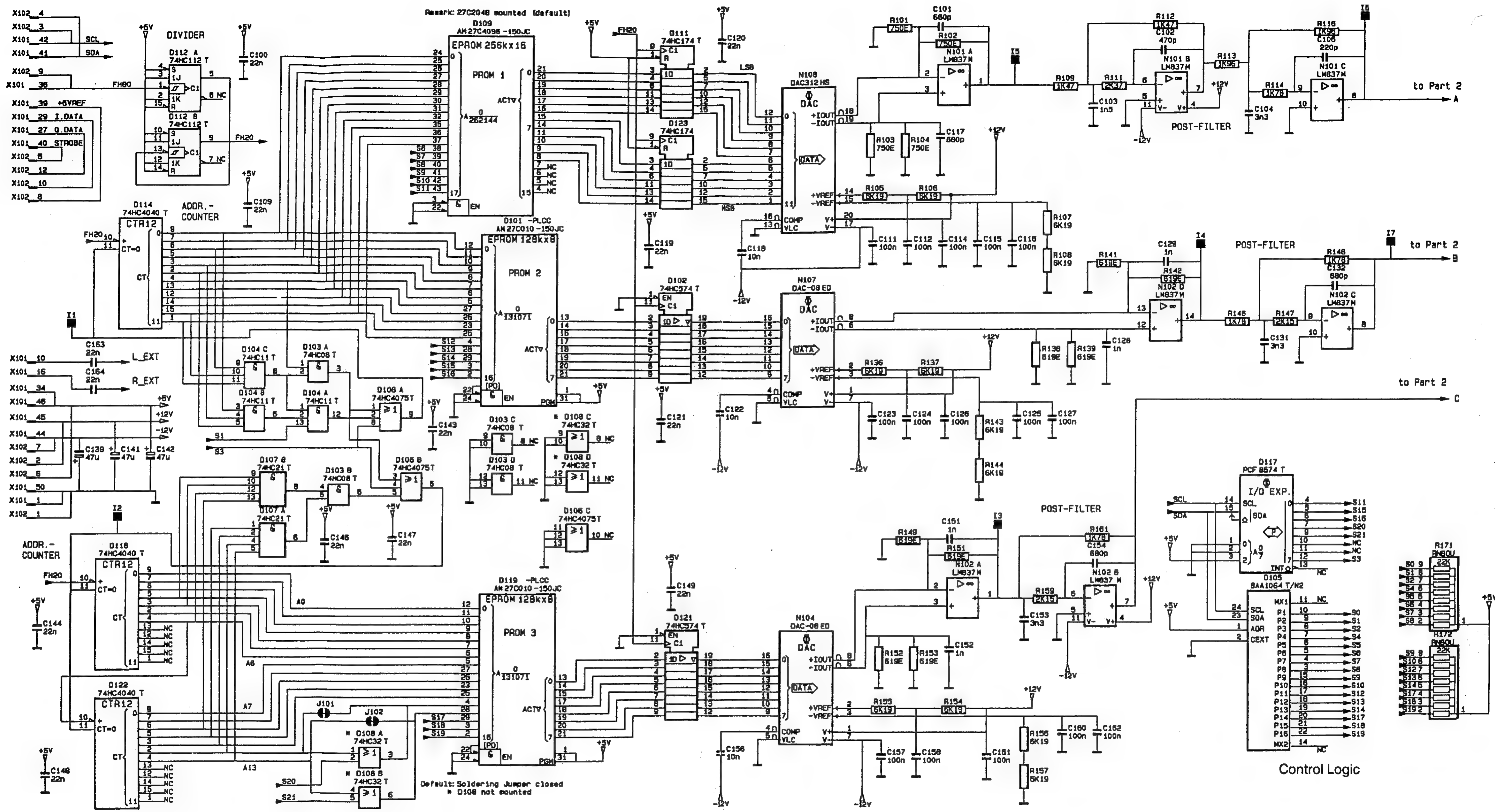
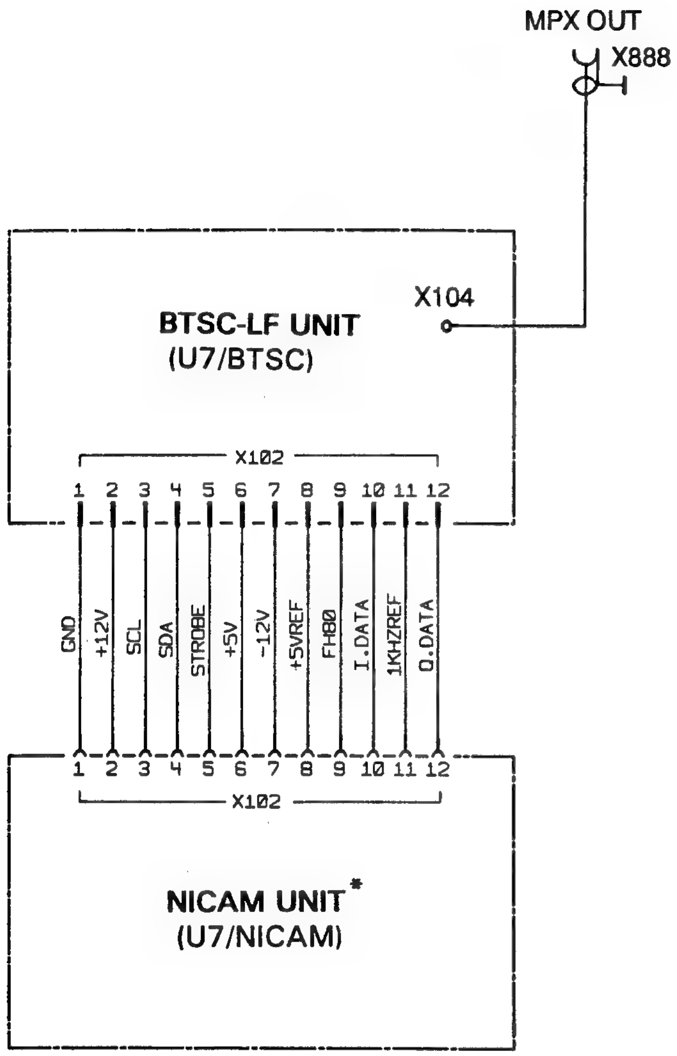


Fig. 159A Unit 7/BTSC, BTSC-LF Unit
Part 1



* only PM 5418 with BTSC sound, for U7/NICAM, see Figure 140

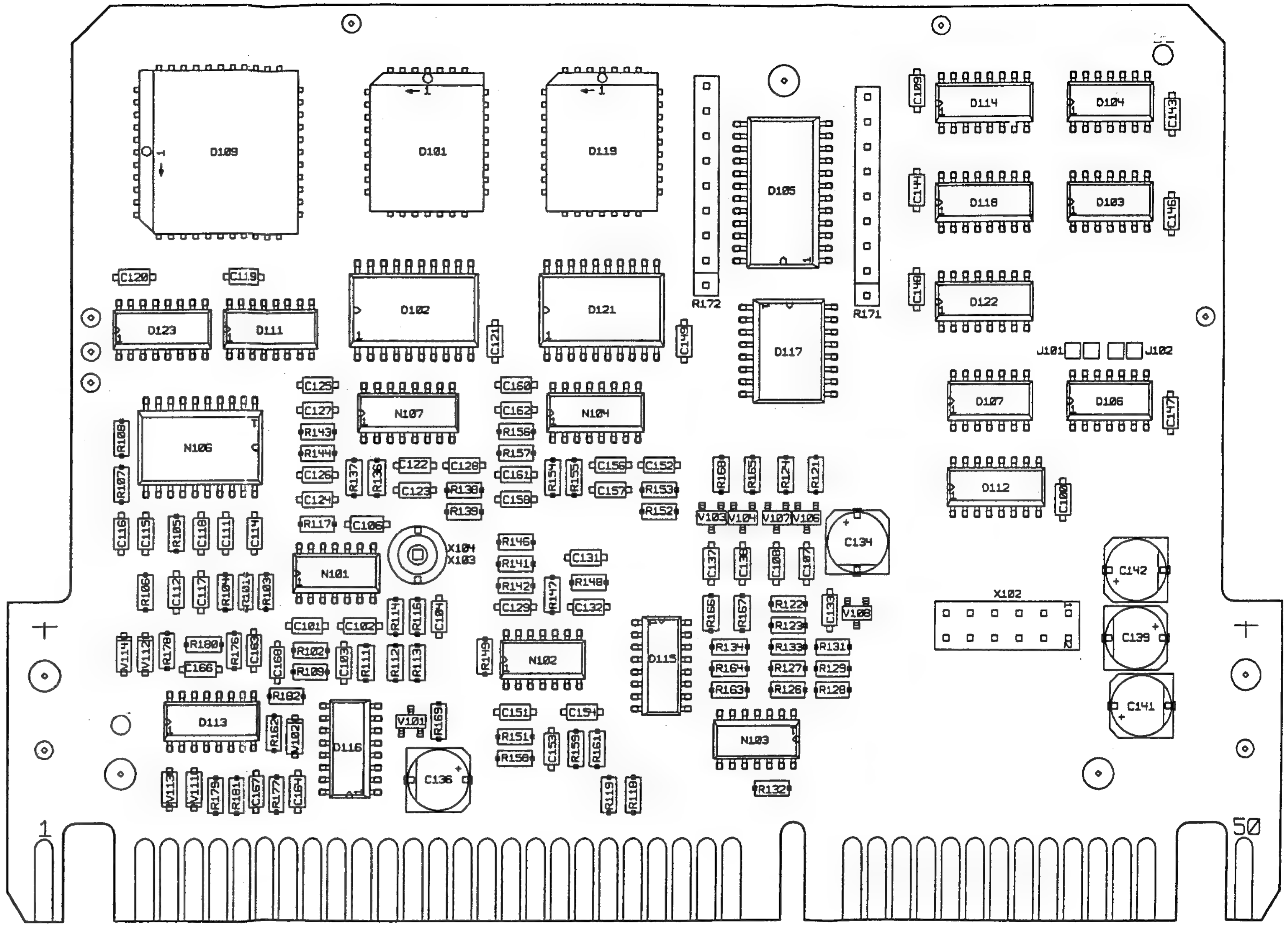


Fig. 157 Unit 7/TRIPLE, TRIPLE-LF Unit

Fig. 158 Unit 7/BTSC, BTSC-LF Unit

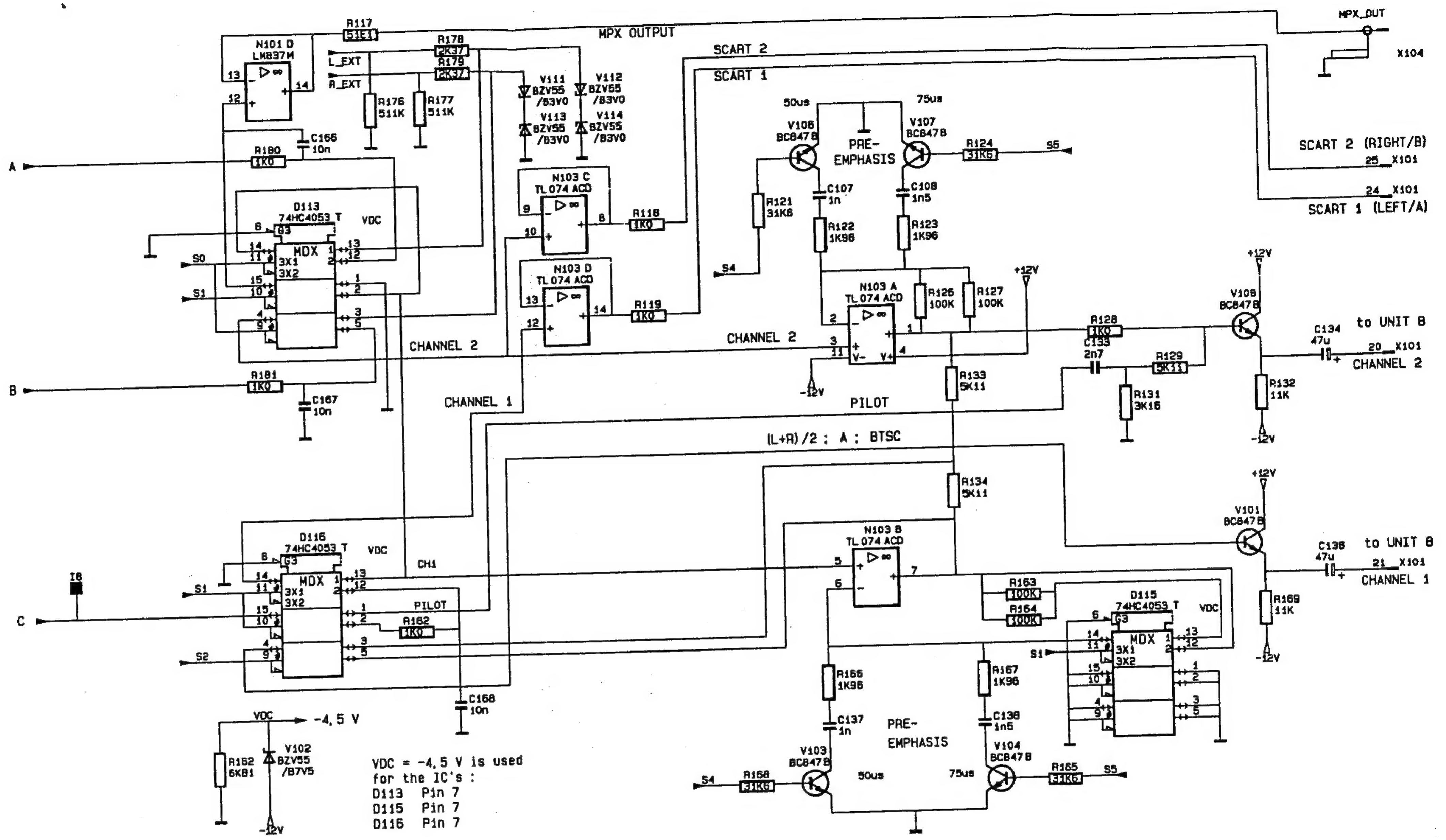


Fig. 159B Unit 7/BTSC, BTSC-LF Unit
Part 2

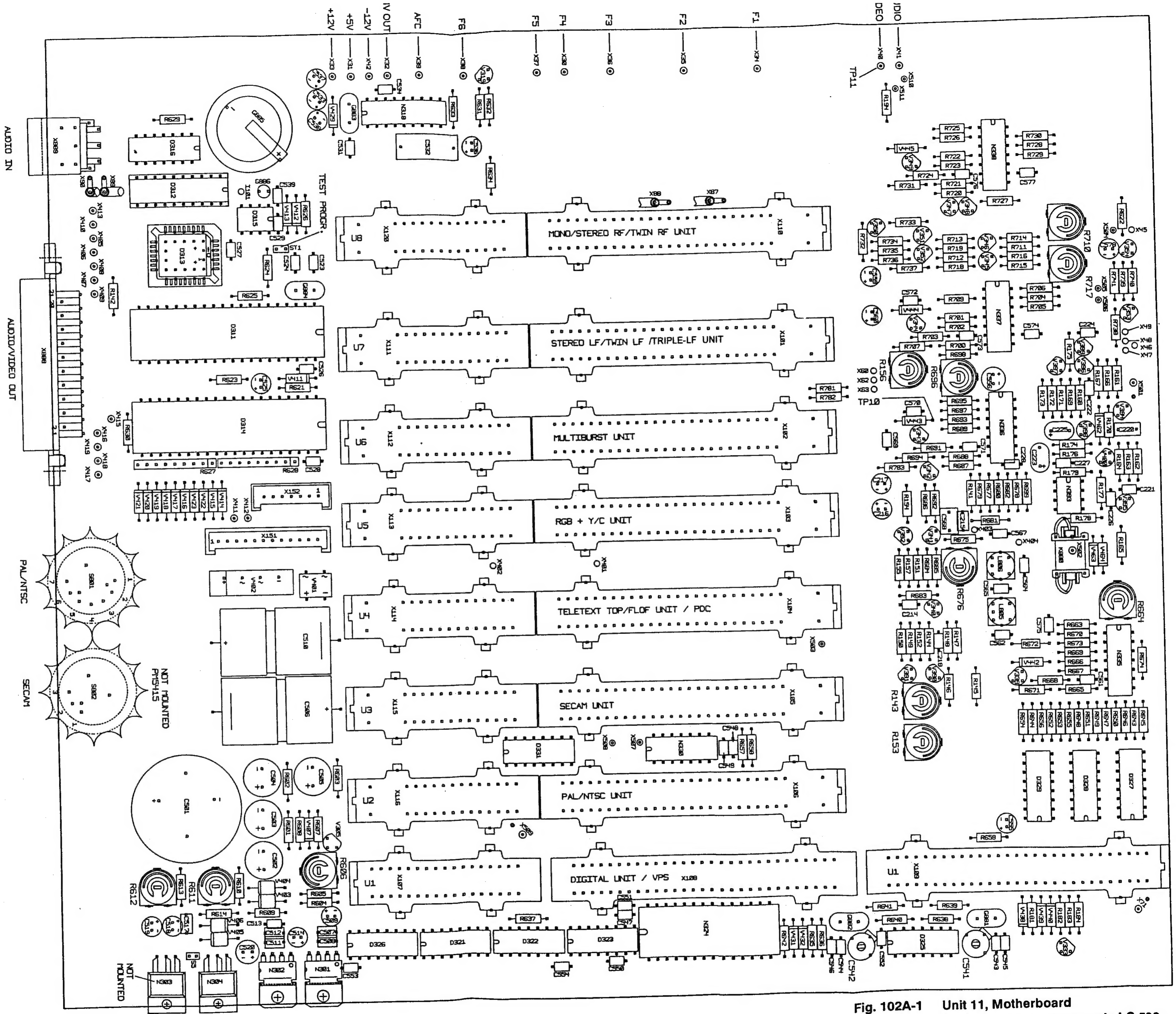


Fig. 102A-1 **Unit 11, Motherboard**
Component Layout onwards LO 599...

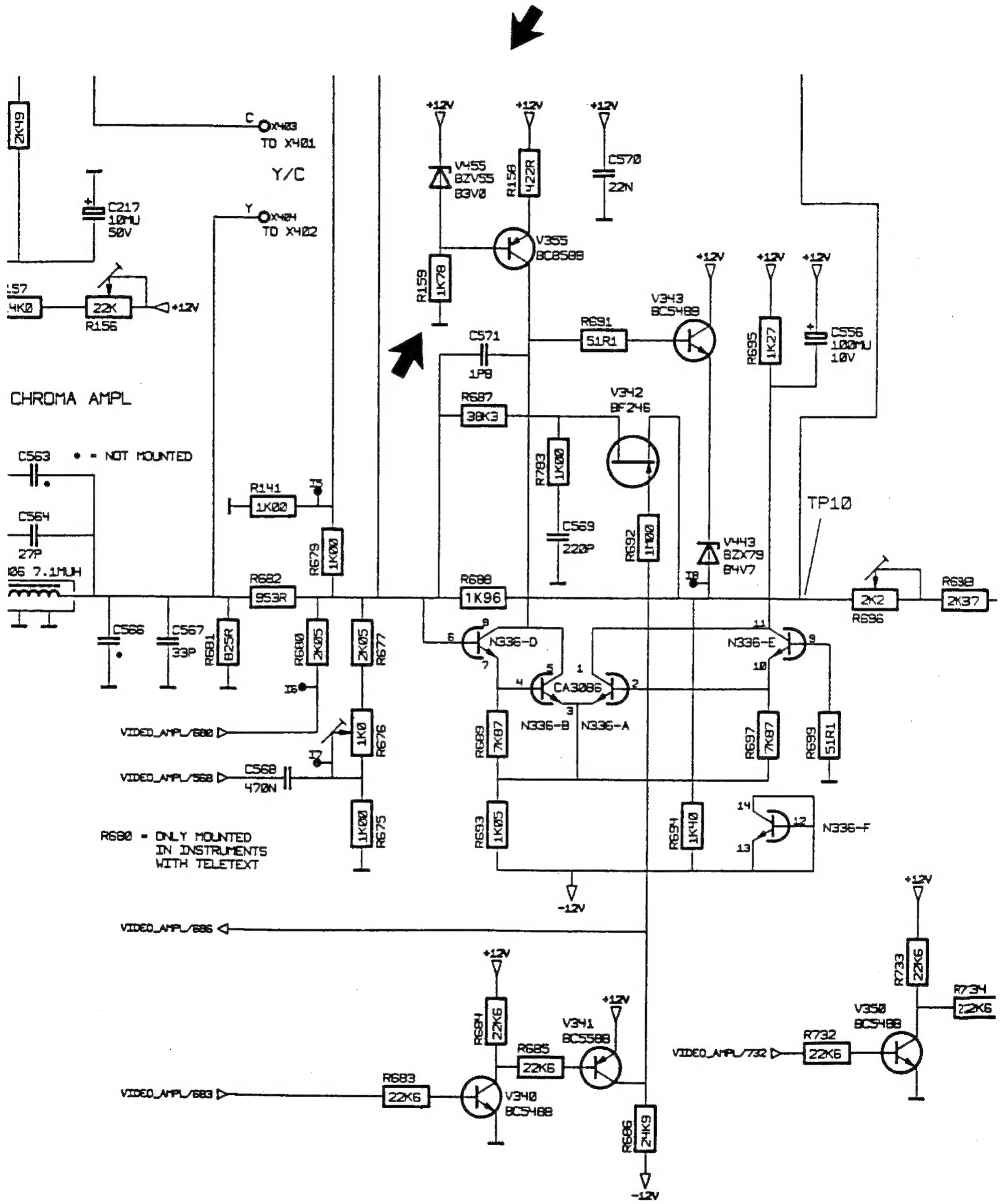


Fig. 106-1 **Unit 11, Motherboard, Part 4**
Modification onwards LO 599...

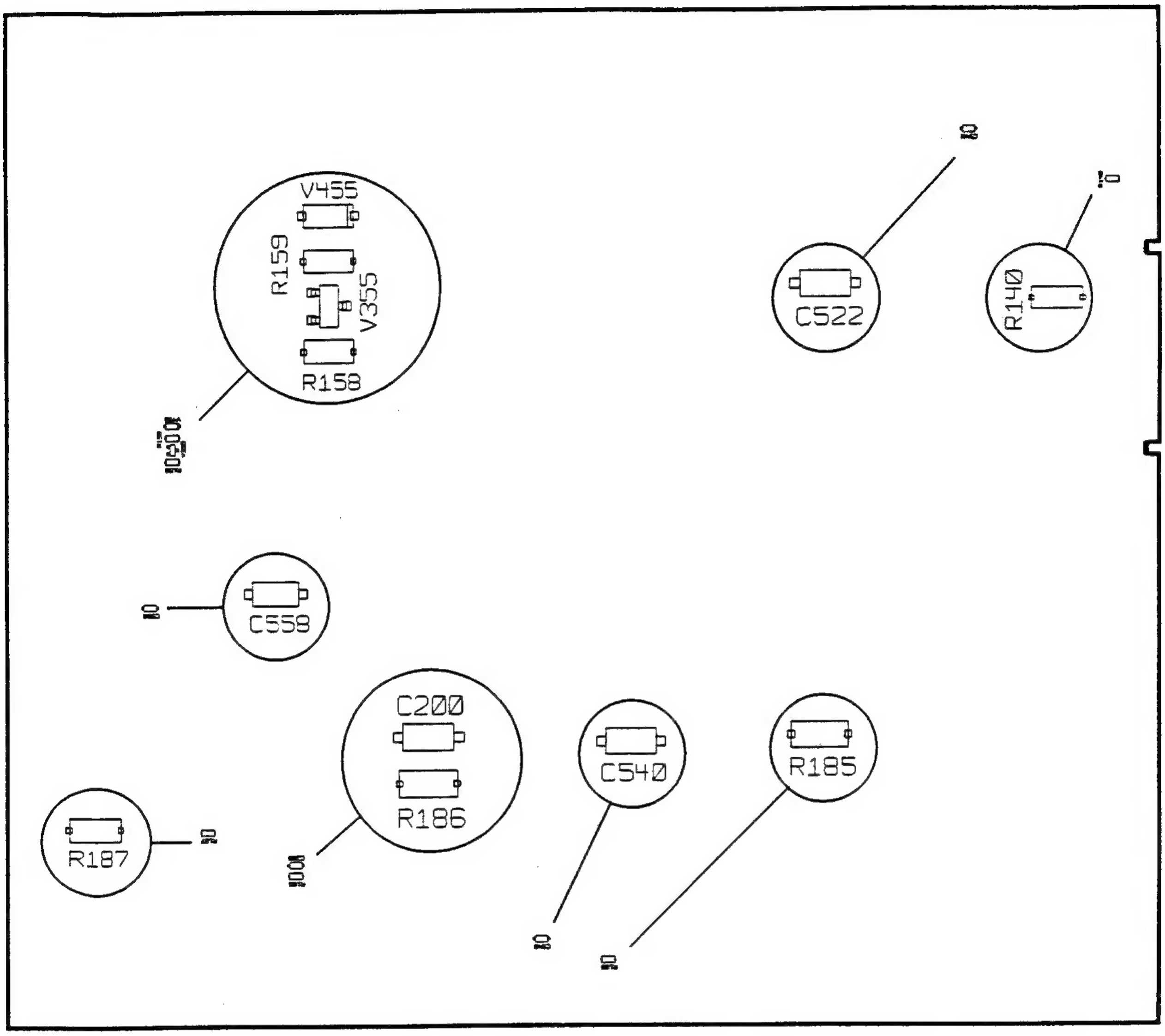


Fig. 102B-1 **Unit 11, Motherboard**
Soldering Side onwards LO 599...